

DIGITAL DENTISTRY

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DIGITAL DENTISTRY (Abstract): The age of full digital dentistry is a new concept, specific to the latest trends of aesthetics, providing superior innovation power in order to reach this goal. In today's world, technological advancements are far from being limited to specific fields. Oral diseases affect a large category of people physically and psychologically, influencing how they look, chew, speak, integrate into the social life. Dentistry is witnessing phenomenal innovations, transforming people's smiles and lives in each and every way. Prosthodontic dentistry deals with the science and art of restoring teeth, both functionally and esthetically. The diversity of cases exposes the practitioners to a wide range of clinical situations and treatment solutions. The replacement of lost teeth with prosthetic appliances may sometimes be a problem for the clinicians, due to the esthetic requests. Among the multiple choices of techniques available for a suitable rehabilitation, the CAD/CAM techniques represent an ergonomic and minimal discomfort solution for the patient, representing a revolutionary method of oral rehabilitation. All stages of each dental treatment should benefit from the very latest technology and best products so the final result being characterized by efficiency and durability. **Keywords:** DIGITAL DENTISTRY, CAD/CAM TECHNOLOGIES, INTRA ORAL IMPRESSION.

Visionaries have long dreamed of digital intra oral impression, then sending the optical impression by e mail, and having their work designed and executed by a trained dental technician in his remote laboratory. The contribution of the dental team on treatment planning, managing the oral health and the interaction with the patient's demands will remain relevant regardless of technology changes. Professional exchanges are important for the advancement of digital dentistry. The CAD/CAM technologies, are constantly moving in new directions, to provide exciting, innovative products and systems, with the highest quality standards. Thanks to CAD/CAM technologies, perfect clinical

restorations can be achieved, with no biocompatibility secondary reactions and excellent esthetic appearance, through a digital cooperation between dentists and dental labs. CAD/CAM technology allows the realization of a well-fitting, aesthetic, and durable prosthetic appliances. CAD/CAM complements earlier technologies used for these purposes by any combination of increasing the speed of design and creation; increasing the convenience or simplicity of the design, creation, and insertion processes; and making possible restorations and appliances that otherwise would have been infeasible. Other goals include reducing unit cost and making affordable restorations and appliances that

otherwise would have been prohibitively expensive. However, to date, chairside CAD/CAM often involves extra time on the part of the dentist, and the fee is often at least two times higher than for conventional restorative treatments using lab services. CAD/CAM is one of the highly competent dental lab technologies. CAD/CAM used in dentistry is based either on subtractive processes such as CEREC technology or additive processes, such as 3 D printing to produce restorations from 3d models to the final prosthetic substitute.

The 1980s represented the first use of CAD/CAM in dentistry. The technique was efficiently used in dental offices and dental laboratories. Chairside CAD/CAM restoration differs from conventional dentistry in that they are fixed in the same day, conventional prosthesis being cemented or bonded in place after a longer period of time. CAD/CAM systems use an optical camera to take a virtual impression, generating a digital cast. A 3D image is forwarded to a software program that can turn the captured images in order to produce and design the prosthesis.

Combining CAD/CAM software with 3D images from 3D imaging system means greater safety and security from any kind of intraoperative mistakes.

Typically, CAD/CAM dental restorations are milled from solid blocks of ceramic or composite resins or zirconia. If the CAD/CAM restorative material is Zirconia the restoration is "radio-opaque", blocking X-rays. Only alumina, lithium disilicate materials are "radio-lucent" (1, 9). According to the used material, CAD/CAM pieces may have some aesthetic drawbacks, whether they are created at the dental practice or into a dental laboratory fabricating center. Depending on the dentist or technician, CAD/CAM restorations can be lay-

ered and baked or sintered in order to get a deeper more natural look.

Stains and glazes can be added to the surfaces of the milled ceramic crown or bridge to correct the otherwise monochromatic appearance of the restoration. The restoration is then adjusted in the patient's mouth and fixed in place (2, 3).

CAD/CAM has improved the quality of prostheses in dentistry and found a way to standardize the production process. It has increased productivity and the chance to work with new materials with a high level of accuracy. It has also found a way to decrease chair time for the patient by the use of intra-oral scanning systems which allow the dentist to send electronic impressions to the lab. CAD/CAM requires a large initial investment. Despite the CAD/CAM being a major technological advancement, it is important that the dentists' technique is suited to the methods of CAD/CAM and milling technology. This includes correct tooth preparations with a continuous preparation margin (which is easy registered by the scanner); avoiding the use of no shoulder preparations and parallel walls and the use of rounded incisor and occlusal edges to prevent the concentration of tension. Similar to the conventional restorations, CAD/CAM pieces present different aesthetic value, many presenting only one shade. In order to create a higher aesthetic appearance feldspathic porcelain is fused to glass-infiltrated aluminum oxide (alumina) or zirconium-oxide (zirconia) (11). For the veneered crowns and bridges, the porcelain is layered onto a metal framework and often the color is influenced by the presence of the dark oxide lines related to the gum line. So, metal-free restorations are typically more aesthetically according to the patient expectations.

Fit accuracy varies according to the

CAD/CAM system utilized and from user to user. Some systems are designed to attain higher standards of accuracy than others and some users are more skilled than others (4).

There are different systems in use: the 3 Shape TRIOS reinvents the digital impression registration. Featuring color digital impressions, shade measurement and HD photos, TRIOS@ PACKS precision and speed into an easy to use, powder-free scanning solution. Enhanced detail capture makes it simple to identify preparation margins and evaluate the clinical situation, while shade measurement instantly identifies teeth shades as we scan. HD photos realize the documentation for each case, esthetic capture and visualize the solution for the patient. The 3 Shape Dental System offers technology-leading dental scanners for 3 D scanning of both physical impressions and gypsum models. The high-speed scanners have the capability to provide the accuracy and detail required for full-arch bridges and implant bars. The full integration with the design software ensures the optimal scan-to-design workflow. 3Shape Dental System™ is known throughout the dental industry as the most powerful CAD CAM design system in the world, supporting familiar workflows, providing the market's most comprehensive dental indication support (5, 6).

An important aspect is represented by the presence of the Sirona Connect portal, which links dentists and dental technicians in a very modern way, so they can exchange data conveniently and securely via the portal. The portal interface is integrated into the dentist's and technician's software, regardless of which software version is being used by either party, thus greatly facilitating workflow.

The 3D scanners and the CAD CAM software solutions are designed for the

creation, processing, analysis and management of 3D data for application in complex manufacturing processes.

The benefits of CAD CAM systems are related to:

- the registration of a digital impression and ordering the restoration online, quickly and easily via the global portal as the Sirona one
- high cost-effectiveness of investment due to:
 - extremely wide range of applications and material versatility
 - maximum precision for all results combined with easy handling
 - high flexibility and future security due to open CAD/CAM interfaces, a diversity of possibilities of integration and the possibility to process additional materials.

It is estimated that many new systems are expected to be present on the domain in the next few years. In the last decades the use of 3D printing techniques for medical and dental applications highly developed. Additive manufacturing is gaining rapid potential in nearly all dental fields. It differs from formative and subtractive manufacturing as in the additive manufacturing process the object is "printed" by adding the building material layer by layer. The application of the 3D printing in dentistry offers the possibility of individualized prosthetic appliances, savings on small scale productions, eased sharing and processing of patient image data and educational upgrading.

The entire process of additive manufacturing technology can basically be divided into four steps: creating a digital 3D model designed with a software or using intraoral scans or computed tomography data, processing and slicing of the 3D model into many two-dimensional layers, printing the 3D end product layer by layer, post-processing of the printed object. This basic

workflow can be applied for the different printing technologies, using a wide range of materials as polymers, metals or ceramics.

Advancement in digital workflow makes it possible to directly print the prosthesis from silicone providing acceptable esthetics and reducing the number of appointments for the patient at the same time.

Minimizing the treatment time and number of appointments is not only favorable for the patient but also precludes the complications and it is possible to achieve the preferred treatment outcomes with expedition of the whole procedure. Another advantage is represented by the leading of an excellent intraoral fit of the prosthetic appliance (7, 8).

Although clinical studies presented patient satisfaction using this technique, further groundwork is required with regards to the stability and comfortable design of the 3D-printed prosthetic restorations.

The importance of 3D documentation in prosthetic has been noticed since the last decade. Plaster models have now been replaced by digital information and data. This does not only solve the bulk storage problems often faced by clinicians, but also opens a new horizon of education and research. Rescuing the patient from repeated exposure to ionizing radiation, 3D-printed models have been used to establish new theorems and relationships between alveolar area and the remaining teeth. In the future it will be possible to use real patient additively manufactured dental models based on intraoral scans or cone beam computed tomography (CBCT) for training fixed and removable prosthetic to dental students (10).

Dental specialists should seek an entire ethical equilibrium of how to get and maintain optimal oral health, being open-minded, compassionate but also expecting the unexpected.

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