CAD/CAM Dentistry

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Through history were many breakthroughs that made human life easier ,and these inventions have great deal of impact on medical life too .in dentistry one of these breakthroughs can be CAD/CAM SYSTEM .CAD (computer aid design) / CAM (computer aid manufacture) can be defined as digital system to make prosthetic teeth .this system start showing up in the industry around 1980's and first commercially available CAD/CAM system was CEREC developed by Mormann and Brandestini. through time it get upgraded ,for better and more advanced operations . this system comes in laboratory and chairside. depending on method selected CAD/CAM ceramic blocks are available for restoration fabrication such as leucite-reinforced ceramics, lithium dislocate , zirconia and composite resin .in order to determine which one of these material should be use ,the practitioner must should take into account esthetics ,strength and ease of customizing milling restoration to produce inlay, onlay, veneers, crown, etc. CAD(computer aid design)/CAM (computer aid manufacture) is introduced to the world by 1980 by the first commercially available system called CEREC. This chairside system allows the dentists or clinicians to independently design and also manufacture ceramic restoration in matter of hours in their own office with only one visit .since ,its first introduction to dentistry field as CEREC 1, this system has evolved through series of upgrade to CEREC 3. CEREC 1 wasn't so much advanced it was only limited in 2D designing and scanning ,it was only able to fabricate exclusively inlay for immediate cementation but by time passing this system got upgraded to CEREC 3, that function with advanced 3D scanning and design . CEREC 3 has expanded capability significantly so that can almost design any restoration, such as inlay, onlay, veneers, crown, as well as three unit bridges and custom lithium disilicate implant abutment in dental field there are also other CAD/CAM systems that have similar functions as CEREC system such as (3M True Definition, 3M True Definition, PlanScan/E4D NEVO, iTero). Dental CAD/CAM is the process by which the tooth or model of the prepared tooth get scanned .the data will get used to generate the copying design (CAD) which in turn is used to generate a cutting path for the milling unit and manufacturing (CAM). The stages of this system can be divided in three steps: Scanning, Software, Miling unit Scanning : in this process the teeth will get scanned for further steps Scanning can happen either none contact sensor(laser point ,laser stripe, white light, photogrammetry)or contact(mechanical) software : The software guides the clinician step by step during the project. The material and the type of restoration (veneer, inlay, onlay, overlay, crown, bridge, maryland or abutment) can be choose. The software allows to select between three options for the design of the restoration: bioreference, biocopy or biogeneric. In the bioreference project, the design of the restoration incorporates the anatomical features of the corresponding contra-lateral tooth, if it is present. The biocopy project reproduces the anatomy of the tooth before the preparation or the temporary restoration, in order to keep unchanged aesthetics and function. In the biogeneric project, the software reads the morphology patient's dentition to predict the right form and function. The optical impression provides data of the both arches and those relevant to their occlusal relationship. Once the virtual model is developed, the clinician can select the insertion axis and mark the margins . According to the type of project and the operator indications, the software generates a restoration. Several tools allow to perform all the changes, which are required such as position, shape, proximal and occlusal contacts. Before data are sent to the milling machine, the software allows to virtually place the restoration into the block material for the best milling position. Milling unit :after all the previous steps are done , all data gathered , they're ready for the processing and manufacturing (CAM) .in this step the right material will be chosen for the purpose of manufacturing ,they ready to process. Milling unit mostly process in three styles :Green processing : milling of pre-sintered ceramic blocks Hard processing :milling of dense sintered ceramic blocks HIP: hot isostatic press The importance of tooth tissue preservation has led to the development of minimal invasive/ultraconservative dentistry. This concept has been supported by continuous introduction of new metal-free adhesive materials, which offer clinical reliability due to enhanced physical and mechanical properties. The amount of tooth reduction depends on the achievement of the right thickness for the prosthetic material. Aesthetics and structural durability are obtained with minimum thickness, since these materials do not require the presence of a metal substructure. The clinician is not compelled to subgingival margin placement, due to the perfect color correspondence between the tooth and the restorative material together with the absence of metal edges. Innovative materials have been proposed by industry in order to satisfy the increased demand for restorations which are indistinguishable from the neighboring dentition over time. Therefore, the first task for such metal-free systems is to provide enhanced aesthetics, but they must also have biomechanical features that ensure longevity similar to metal-ceramic restorations. These materials are fabricated, in ingot form, with reproducible and constant manufacturing processes. The mechanical and physical properties allow to these materials to be milled rapidly, resist machining damage, be finished easily (for example, polished, stained or glazed) before placement and be functionally stable. The lack of metal core provides two benefits: highly aesthetic appearance and minimally-invasive approach. Metal-free restorations in fact can resemble natural tooth structure in terms of colour and light translucency, since no light transmission is blocked by the dark substructure. Optical continuity from tooth structure to restoration is further improved by the bonding mechanism. The second advantage is the conservative tooth preparation, since the thickness for the metal is no more needed. There are many types of material use in CAM such as :Lithium disilicate: IPS e.max CAD (Ivoclar Vivadent AG, Schaan, Liechtenstein) is a lithium disilicate glass-ceramic for CAD/CAM applications Leucite glass-ceramic: Pro CAD was the first available leucite-reinforced glass-ceramic CAD/CAM block .To date it has been replaced to the current IPS Empress CAD (Ivoclar Vivadent AG, Schaan, Liechtenstein), Feldspathic ceramic: VITABLOCS Mark II (VITA Zahnfabrik, Bad Sackingen, Germany) is a monochromatic feldspathic ceramic and its abrasion coefficient is fully comparable to the tooth enamel. It is recommended for inlays, onlays, veneers, posterior and anterior crowns. This feldspathic ceramic is now also available as TriLuxe and TriLuxe Forte, which are made of three and four layers with different shade intensity respectively. These multi-layer blocks assure restorations featuring natural shade transition. The most recent material developed is the VITABLOCS Real life, which is recommended for highly aesthetic anterior restorations, due to its dentine core and enamel coat. This feature mimics the curved shade transitions between dentine and incisal edge according to natural tooth structure. The same features are also provided by another material, which is called Cerec block (Sirona, Bensheim, Germany) Hybrid ceramic: ENAMIC (VITA Zahnfabrik, Bad Sackingen, Germany) is a newly-developed hybrid material that combines the positive characteristics of proven ceramic materials with those of the composite materials. Resins: Paradigm MZ 100 (3M/ESPE AG, Seefeld, Germany) is a definitive, aesthetic and radiopaque material, that under optimized process conditions, assures a deep cure due to a high degree of crosslinking. This process improves physical properties and clinical performance. Lithium silicate with zirconia: Suprinty (VITA Zahnfabrik, Bad Sackingen, Germany) is a lithium silicate ceramic (ZLS) enriched with zirconia (approx. 10 %). This new glass ceramic features a special fine-grained and homogeneous structure, which guarantees excellent material quality and consistent high load capacity. Thanks to the excellent translucency, fluorescence and opalescence of this new glass ceramic material, VITA SUPRINITY provides excellent aesthetic properties. Adhesive luting: Adhesive cementation has been clinically proven to be a suitable procedure for the permanent seating of indirect restorations, but a restricted protocol must be used by the clinician .A careful isolation by means rubber dam and retraction cords is required in order to maximize the predictability of the adhesive luting process. After going through all these process , the result that we can get is way better than the traditional ways in many factors such as time, efficiency, etc. The CAD/CAM system will give us the opportunities to make better restoration , more accurate , with more strength and with least chance off mistake and also for patient is way more comfortable because less time will waste for the visit for the dentist and they will finish they restorations faster in a more conservative way. CAD/CAM system since the time it got introduced to dentistry field had many upgrades and got more advanced compare to CEREC 1 system. Through time it becomes more reliable system in dentistry due to its perfect designing and its time set ,it can help the dentist to finish up the restoration for a patient in single visit with least amount of complication in the process .clinicians around the world getting acquainted with this system ,but since its new technology and its learning curve, costs, the limited number of dedicated materials as well as the range of uses, the lack of long-term follow-up have made dentists skeptical and suspicious of this system . However, clinicians have had to face the increasing demands of patients for fast, highly aesthetic and minimally invasive treatments. Thanks to technological developments of the last three decades, the initial limits of the chairside system have been overcome. To date it is faster, more intuitive and user friendly.so ,because of this the manufacturer of these system and material due to the high requests of this system in the dental field they start expanding , New materials are daily developed and supplied by material manufacturers, which have increased their research. so since they have noticed the potential profit they start investing and manufacturing more that past years . With almost 40,000 users worldwide, today this system could and should be considered a viable alternative to traditional procedures. Cad/Cam system (CEREC) is a useful tool for the clinician , this system can help the dentists to make highly aesthetic and reliable restorations in a single visit with this chairside system, designing and manufacturing can happen in the office with lesser time and cost. Material that should be used in the milling unit depends on the restorations . dentists can put their faith in this system over the time, with new technologies and developments this can be the future of dentistry .

***Key words**: cad/cam dentistry ,cerec , miling unit ,scanning, software , prosthetic.*