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Application of Machine Learning in Cad/Cam Using Recent Trends and Advancement

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ABSTRACT: The full sum up and the fine review that is conclude is that the CAD/CAM systems are the current-day requirement. CAD/CAM systems paintings excellent inside the included form and they are not best limited to the engineering world however to each and every corner of the system heritage. Integration of the machine has given birth to the CAPP, ERP, DNC and production and improvement. Designing has been nicely superior and meets the necessities of the venture, not only large however the gadget of CAD/CAM is state-of-the-art for the small industries. CAD/CAM is the requirement of the each managerial in addition to engineering and processing industries climate it's miles the method or operation coping with or the manpower and aid managing or assembly the lifeless traces of the deliveries. Simulation is likewise performed by means of this system and the challenges within the contemporary-day world for the survival in the speedy converting and growing global can be sponsored through the included CAD/CAM systems. Prototyping, reverse Engineering, Additive production, sensible management all are the capabilities of the CAD/CAM machine. system learning can assist us to broaden the designs which would have minimum errors and after the rescans and exams the AI a part of the software will totally do away with the error. Designing on CAD and production strategies may be a whole lot more benefitted by means of sharing information between distinct structures in a firm will permit machines research the traits and patterns and could optimise the system and improve it in addition. The main reason of this have a look at is to study various techniques and strategies for scanning, designing, and fabrication of CAD/CAM generated restorations together with detailing the new classifications of CAD/CAM era.

KEYWORDS:CAD/Cam, Program Language, Artificial Intelligence, machine Learning.

I. INTRODUCTION

With the rapid development of CAD/CAM (Computer Aided Design, Computer Aided Manufacture), it has had a dramatic impact on all areas of dentistry, especially in prosthetic and restorative dentistry. Integration of these technological systems with advances in biomaterials. B. High-strength zirconium oxide ceramics have revolutionized education and patient care. Therefore, the landscape of dental education is changing in terms of cost-effectiveness, time-efficiency and, most importantly, predictability of postoperative clinical care and implementation. The benefits of CAD/CAM technology are incorporated into three major protocols including digital impressions, digital models, virtual articulators and facebows. Moreover, prosthetic care is a complex integration of a suite of techniques involving patients, clinical students, faculty, and business labs at multiple levels. Therefore, the purpose of this study is to investigate the different methods and techniques used to scan, design, and manufacture CAD/CAM-generated restorations, and to describe a new taxonomy of CAD/CAM techniques, currently published. It is to check the published literature. It should be noted that there is considerable variation in acquisition systems, CAD design mechanisms, and CAM manufacturing processes. Therefore, please note that not all systems can develop the full range of restorations required for individual prosthetic solutions.

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II. LITERATURE REVIEW

Pandey et al. has done research in order to briefly explain the role of the CAD/CAM Design, Development and Manufacturing in Modern Manufacturing Technologies, as the advancement of the processes are complexing day by day and need the best in the class to withstand the advancements and the intelligence needs to be put into the field of all the discussed parameters. The research gives an open and wide idea to incorporate the interdisciplinary design actions which would connect their common goals. To do this we need to study and investigate the present-day state of art, latest trends in engineering design, new approaches, with the addition of industrial problems, and which of the requirements are demanding the inclusion of CAD/CAM. The research has been conducted with the aim of direct future research, and the development activities by the inclusion of studies done by the Germans leading CAD/CAM magazine. Which made the authors possible to reach the possibilities of the future role and possibilities of the emergence and reachability of the CAD/CAM. Authors have well defined the role and has well explained the future role and defined the steps to be followed in the application of Rapid Prototyping. It is t e new face of manufacturing, and it is incomplete without designing so again the need for CAD/CAM come into existence. Author has explained the top-up and top-down manner of creating electrical mockup. Author has defined the agile manufacturing conception and the enabling technologies, where customer needs are studied and satisfied and keeping the cost and sales quality.

Ko et al. have effectively defined the user-friendly CAM software and presented the functionality of automatically generated three-dimensional tool path and imparting the CAD drawing. The authors have defined the complexities which came into play when we need to draw a trajectory of few microns dimension and multidirectional moves. The reported CAM software offers constant velocity for all short trajectory elements and provides an efficient shift of tool path direction in sharp corners of a tool trajectory, which is vital for any laser, based precision machining. Authors have also made the functionality well defined and detailed research has been conducted over the CAD/CAM software and the file and format systems.

Shukla et al. the authors have been incorporated the role of CAD/CAM in the designing for skill development and has given the deep reviews related to the skill development and the interdependency of computer-aided design (CAD) and computer -aided Manufacturing (CAM). The technology has greatly influenced the continuity of the processes which have an interdependency, and they share the computer-based applications which have a sharing for the design and development. And sometimes the amalgam is called the third technology called Computer-Aided Engineering (CAE). Authors have defined the literature from different other authors for review and explaining the further advancement of the use of the software has nullified the ambiguities in designing work and the skill development. Authors have emphasised the saving of time and money by use of CAD/CAM technologies.

III. CAD/CAM COMPONENTS

CAD/CAM systems are composed of three major parts:
(1) A data acquisition unit
(2) Software for designing a virtual restoration on a virtual working model and then calculating milling parameters.
(3) Computer-assisted milling equipment for making restorations from solid blocks of restorative material or additive manufacturing.

IV. GENERAL CLASSIFICATION OF CAD/CAM SYSTEM

CAD/CAM systems are divided into lab systems and chairside systems. Laboratory Systems is further subdivided into Laboratory CAD/CAM, which has its own scanners and milling units (e.g. Amann Girbach, 3MESPE, Sirona Dental Systems, Zirkon Zahn, vhf camfacture AG, Weiland Dental, Pou-Yuen , U-Best Dental, Planmeca, KaVoDental, Dentsply Prosthetics) and CAD (Computer AidedDesign) systems (D2000, 3 Shape, Dental Wings 7 series, Dental Wings, IScan D104, Imetric 3D SA, Ceramill Map, AmannGirrbach, etc.) ; Activity 850 3D, Smart Optics) and the CAM (Computer Aided Manufacture) system under which the company maintains the milling unit (e.g. DWX-50, Roland DGA Corporation, inLab MC X5, Sirona, M5, Zirkonzahn, Tizian Cut 5 Smart, Schütz Dental; S2 Model, vhf camfacture AG; Ceramill Motion 2, Amann Girrbach).

CAD/CAM system is further classified into:
(1)chairside CAD/CAM system in which the company has its own scanner and milling units (Sirona and Planmeca)
(2)Image acquisition system in which the company has only a scanner without designing capabilities (e.g. True Definition Scanner, 3M ESPE; iTero,

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Align Technology, Inc; Trios, 3Shape;Apollo DI, Sirona; CS 3500, Carestream Dental LLC). These in turn must be connected to an open laboratory scanner for designing of the restoration.

Laboratory scanners are classified into

An optical scanner that projects a measuring grid of light onto the tooth structure at a specific angle, causing a depth-dependent phase shift of the grid and recorded by a camera on its digital sensor. A computer calculates his 3D data of the tooth structure from the images of the depth-modulated measurement grid.

(2) A mechanical scanner (such as his Procera Scanner from Nobel Biocare) that allows him to mechanically read the master model line by line using a ruby ball to obtain 3D measurements.

Design Software

Manufacturers offer special software for designing different types of dentures. With different software from different manufacturers, various designs can be imple_mented such as copings and fixed partial denture (FPD) frameworks, full anatomical crowns and FPD, inlays, onlays, veneers, table-tops and non-prepared veneers, temporaries including FPD and pontics,diagnosticwax-up including physical models, post and core, telescopes, customized abutments with positioning guides, implants FPD and bars, implant planning with surgical guides, removable partials, denture design including impression trays, splints, model builder (crown and FPD/Implants), orthodontics and appliances can be designed. The final anterior restorations can be fabricated through a copy scan of the models of temporary restorations to compensate for the anterior guidance table and silicone matrices.

The alternative method is to use the database of the biogeneric tooth morphology to identify and imitate the individual occlusal morphology of a patient. With the digital CAD model being visible on the computer monitor, it can be rotated in three dimensions as well as magnified to evaluate critical areas of the model prior to transmitting the file to the manufacturing process. Furthermore, the recommended die spacer thickness can be selected thereby eliminating the use of manual application of die spacer with different colors

V. DIGITAL FABRICATION PROCESS

This is the last phase of the dental CAD/CAM process. It involves developing a restoration from a CAD model into a physical part that undergoes processing, finishing, and polishing before being inserted into the patient's mouth. The two primary methods used to fabricate these restorations may be subtractive (milling and grinding) or additive manufacturing (Rapid Prototype, RP or 3D printing).

Milling/machining technology is a type of restoration fabrication that utilizes subtraction manufacturing technology from large solid blocks. The technology dentists and technicians are familiar with is computer numerically controlled machining (CNC), which is based on processes in which power-driven machine tools are used with a sharp cutting tool to mechanically cut the material to achieve the desired geometry with all the steps controlled by a computer program. The choice of milling machine depends on the application. The

milling machine is divided into two classes as shown in Figure 2. (A) Abrasives that require dry / wet / milling and dry milling and abrasives that require a wet mill Axis (3 or 4 or 5 axes).) Both the 4th and 5th axes move linearly up and down through different axes (X, Y, Z). The main difference is the number of revolutions. The block / disk rotates only around the X axis (A rotation), but with 5 axes, the block / disk rotates around the X axis (A rotation) and the spindle rotates around Y. Axis (B rotation). The main differences between 4-axis milling machines and 5-axis milling machines. Furthermore, restorations milled with a 5-axial milling unit have a greater accuracy than those milled with a 4-axial milling unit because 5-axial milling unit can mill undercuts in all directions. Not all 5 axes milling units are the same because of differences in the amount of A and B rotations.

Additive manufacturing is defined as the process of joining materials to make objects from 3D model data, usually layer upon layer. Once the CAD design is finalized, it is segmented into multislice images. For each millimetre of material, there are 5–20 layers in which the machine lays down successive layers of liquid or powder material that are fused to create the final shape.

VI. LIMITATION OF CAD/CAM TECHNOLOGY

The camera is line of sight. In other words, the camera can only record what the camera lens sees. Therefore, such structures or edges that are obscured by saliva, blood, or soft tissue are invisible to the camera and are not recorded accurately. The disadvantage is that there is no disk-shaped glass-ceramic. Once available in disc format, press technology is probably gone. Furthermore, additive technology is limited to polymer and metallic materials, ceramics are not yet included in dentistry.

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Another limitation is the limited accuracy of full-arch digital impressions compared to conventional impressions. In addition, it has been found that tooth zirconia frameworks that require longer curved frameworks are more susceptible to greater sintering deformation than shorter straight frameworks, which can affect fit and adjustment. . Zirconium oxide frameworks fit precisely only in partial arch prostheses.

VII. FUTURE AND SCOPE OF CAD/CAM TECHNOLOGY

In the future, ultrasonic impressions will be performed using ultrasound that can penetrate the gingiva non-invasively without a contraction cord and is unaffected by saliva, groove fluid, and blood. This eliminates detailed cleaning and drying of the oral cavity and associated tooth structures, resulting in significant advances in shorter treatment times and improved patient comfort compared to optical impressions. In addition, restorations are manufactured by laser milling and / or direct injection printing of zirconium oxide and glass ceramics. In addition, in the future, ultrasonic impressions will be used with monolithic restorations.

Future work that can be done via CAD / CAM is the ability to add AI (artificial intelligence) to the software. This has the potential to help develop convolutional neural networks that can be intelligently designed and manufactured, similar to human neurons.

VIII. CONCLUSION

1. In today's world where management and manufacturing are the building blocks of industry and the race for progress and improvement is complex, we need a perfect system to help the industry get out of trouble.
2. The computer has been man's friend since it was developed and put to work. The scenario has changed even more, with computing applications found everywhere, from the manufacturing sector to the aerospace industry to the medical sector. You need integrations that help you sync your data and get better results. CAD/CAM (Computer Aided Design and Computer Aided Manufacturing) is currently being developed and integrated. Both applications have brought significant efficiencies to the industry.
3. CAD is used to create designs using modern computers, these designs are simulated and then purchased to the particle field and development begins.
4. CAD applications can be linked with artificial intelligence used in many fields where computers provide suggestions on how to design and optimize it. You can also add machine learning to your CAD system to make it much more advanced and creative. Taken to the next level of development.
5. CAM (Computer Aided Manufacturing) is a type of application that manages all manufacturing tasks in the same way as CAD, but requires the system to be synchronized with available resources, materials, and personnel with other manufacturing needs. There is a difference that there is It gives us the best solution.
6. Adding AI (artificial intelligence) to the CAM system can improve performance. Machine learning can improve system performance without having to repeat loop tasks. CAD/CAM integration is a revolution that requires only a single system application, making it easy for all design and manufacturing operations to be performed and data flow can be sent to any channel required.
7. Interestingly, CAD/CAM integration has evolved computer graphics systems for better understanding. Engineering analyzes (such as stress-strain) can now be designed using the software and automated drawing can be easily performed

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