

Role Of CAD-CAM IN PROSTHODONTICS –A REVIEW

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ABSTRACT

The CAD CAM in dentistry describes about the indirect restoration designed by computer and milling done. It consist of three steps which are scanning , designing and milling. This review paper describes about the CAD CAM technology in Removable partial denture, implant, fixed partial denture, complete denture and maxillofacial prosthesis. And also explains about the merits ,demerits and limitation of it.

INTRODUCTION

CAD-CAM is an acronym of computer aided design and computer aided manufacturing.

The world of dentistry has undergone numerous changes and is steady evolving towards the digital world.

It is been widely used in dental laboratories and dental offices for accurate designing and fabrication

of various restorations like inlays, onlays, crowns, veneers,implant abutments, cast removable partial dentures and even full mouth rehabilitation.

This completes earlier techniques used for these purposes by combining speed of design and accuracy , with simplicity in design , creation and insertion process.

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ROLE OF CAD-CAM IN PROSTHODONTICS

HISTORY:

The first application of CAD-CAM technology was initiated and described by Duret and Preston, the pioneers of dental CAD-CAM technology in 1991.

In 1991, Duret and Preston are the pioneers of dental CAD-CAM technology and they initiated and described about the first application CAD-CAM technology.

In this early system, the tooth preparation was scanned (optical impression) using intraoral digitizer for allowing 3D graphic to be reconstructed on a computer monitor.

The 3D graphic reconstruction was done by optical impression (scanning of tooth preparation) using intraoral digitizer

Mormann along with Dr.Brandestini manufactured a tooth coloured posterior indirect dental restoration which was called as CERAMIC RECONSTRUCTION and was popularly known to be CEREC in 1985.It is important in providing same day ceramic restorations.

Dr.Anderson developed procerasystem in 1983 , This has a central processing centre with satellite networking centre under this unit.

OBJECTIVES:

Their main aim is to eliminate the traditional impression methods by designing and machining the restoration with the use of computer and softwares.

This system is mainly aimed to improve the qualities of restoration and to decrease the chair side time.

CAD-CAM COMPONENTS:

They constitute 3 components,

A Scanner (laboratory/intraoral)

CAD (designing software)

CAM (milling device)

Scanner: Computer surface digitization

It is mainly used for collecting the data/information from a teeth or tooth that is prepared, which is transferred to 3D-data and it is used for designing and milling.

There are various types of scanners

Laboratory Scanner

Optical Scanner/SD Scanner

Mechanical Scanner

Intraoral scanner

The quality of restoration mainly depends on the data and their accuracy.

The scanner data can be incorporated to the CAD system for further designing and milling.

CAD (Designing software)

The CAD software has got pre-loaded libraries designs for crowns , bridges , inlays , onlays , implants etc.,

In the CAD software the data will be uploaded, then the laboratory steps will get started, the design of restoration is fabricated by using various file formats.

Standard triangle language (STL) is the file format for CAD software. A 3D

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designed dental restoration would be sent to the CAM device for milling.

CAM (MILLING DEVICE)

By installing both hardware and software, the final product of the restorative material is fabricated using milling device.

The number of movement axes by which blocks are trimmed according to the design and by using linear axis like X axis (horizontal). Y axis (depth), Z axis (vertical), the movement of the milling tools , the detailed design is fabricated.

OTHER METHODS

ADDITIVE MANUFACTURING TECHNIQUE

The process of joining materials to make object to form a 3D model from obtained data, usually layer upon layer; thus forming series of cross-sectional layers.

There is no waste of material in this technique, and some of the advantages are allows the business to produce parts faster and at lower cost than traditional subtractive techniques. Examples : ink jet printing, stereo lithography, direct metal laser sintering, selective laser sintering

SUBTRACTIVE MANUFACTURING TECHNIQUE

It is the process by which excess material is cut/removed mechanically to achieve the

desired 3D model. This mainly reduces fabrication time that results in waste of material.

WET PROCESSING

A coolant liquid is commonly used to prevent over heating of the material during fabrication and processing the restoration.

Their main advantage is the precise size and shape of restoration during milling with no shrinkage on sintering.

CADCAM TECHNOLOGY IN REMOVABLE DENTAL PROSTHESIS.

Cast partial denture is fabricated using Co-Cr alloys/ commercially pure Ti and Ti-6Al-4V. Using CAD-CAM software, either impression is scanned or intra-oral scanner or digitiser is used through which 3D virtual design is done and is milled out to provide a final outcome of 3D model of cast partial denture with precise and accurate details.

CAD-CAM TECHNOLOGY IN IMPLANT PROSTHODONTICS

Fabrication of custom made implant prosthesis is successful with the advancement of CAD-CAM technology. Custom-made abutments are designed according to their data/details obtained from scanner.Fabrication of details is done by using titanium alloys which is further milled and it gives an advantage to

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duplicate as a natural teeth. This helps in obtaining precise / ideal coronal preparation with correct path of insertion and profile, implant axis This mainly reduces the chair side time.

CAD-CAM TECHNOLOGY IN FIXED PROSTHODONTICS:

The data is recorded using scanner and CEREC in lab system helps in designing and fabrication of 3D restoration. A ceramic ingot has placed in milling chamber and with the obtained design 2 diamond in milling chamber provides precise cuts (subtractive technique). In cases of esthetic concern , porcelain built up is done and final outcome of the restoration is obtained. Which is then checked with modifications. This helps in providing precise and accurate prosthesis . This reduces the chair side time.

CAD-CAM IN MAXILLOFACIAL PROSTHODONTICS:

A 3D resin models of maxillofacial structures can also be fabricated using CAD_CAM technology. Wax pattern is fabricated and computer assisted design is fabricated in a 3 dimensional form and thus milled using computer aided milling machine. Most commonly silicone prosthesis is fabricated using CAD- _CAM technique .

ADVANTAGES:

The most advanced technology has many uses like,

It acts on alternative for traditional impression making.

It Provides more precise and accurate data and thus 3D models of restoration .

It reduces chair side time and laboratory time.

It provides better esthetic and finishing.

High strength material with superior esthetics can be obtained from newer modified dental materials

LIMITATIONS:

High cost of CAD_CAM system.

Regardless of digital methods , clinical parameters like saliva , blood , movement of patients can affect accurate reproduction of teeth .

CAD_CAM milling can induce surface/subsurface flaws that affects the strength of the ceramics .

It can be done by well trained individuals.

CONCLUSION:

Thus , CAD-CAM system continue to improve in accuracy and versality and as a part of routine dental practise in upcoming period but it is used by doing its limitations.

Thus a combination of both conventional and advancement helps in meeting the patients demands.

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