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Application of CAD/CAM Technology in Dentistry

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ABSTRACT

3D printing has been heralded as a game changing innovation that will revolutionise manufacturing technology that is used in aerospace, military, art and design is becoming a hot topic in healthcare. With developments with 3D modelling and process such as CBCT computed tomography and intra-oral scanning, as well as a strong tradition of CAD/CAM use in dental care, the technology will become increasingly relevant. 3D printing uses include screw guides for implants, physical replica for prosthodontics, orthodontics, including surgery and the production of dental, craniomaxilar, including craniomaxillary implants.

Key words: Obstructive sleep apnea, Orthodontic treatment

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INTRODUCTION

In today dentistry communication technology is critical. Information and computers are being used in prosthodontics, surgery and dentistry technical laboratories as a form of interactive communication. Specifically, when it is necessary to replace pathologically altered tissue that has been removed [1].

LITERATURE REVIEW

Methods

Direct CAD/CAM: Allow physicians to create a prosthetic in only one appointment. In their procedure, all stages are completed. Until the intra-oral optical replica is restored, it is processed on-site.

CAD/CAM semi-direct: At least one consultation with a doctor is required; the data gathered first by physician can be filtered in the local clinic to bring out the CAD or transmitted in real time to a digital laboratory or machining centre for immediate interaction with the manufacturer, in order to create both the facilities and the purely aesthetic element.

CAD/CAM (indirect): The clinician creates a typical chemical impression by hand, which will then be sent to a prosthetist or machining centre. As a result, all phases of the chain are farmed.

How does CAD/CAM Technology in Dentistry Work

- Taking anatomical impressions during an intra-oral scan
- Tooth preparation
- Oral laboratory
- Scanning in three dimensions
- Shaping
- 3D printing of tooth cementation

RESULTS

In all dentistry branches, the use of chair side CAD/CAM technology holds promise in terms of reducing the effort it takes by practitioners, techs, and patients to restore and maintain patient oral function and aesthetics while keeping excellent quality.

With developments with 3D modeling and process such as cbct computed tomography and intra-oral scanning, as well as a strong tradition of CAD/CAM use in dental care, the technology will become increasingly relevant. 3D printing uses include screw guides for dental implants, physical replica for prosthodontics, orthodontics, including surgery, and the production of dental, craniomaxilar, including craniomaxillary implants [2].

Depending on where the parts of the CAD/CAM systems are placed, three different fabrication concepts are accessible in dental care:

- A table top creation

- Manufacture in a workshop
- A production with centralised fabrication centre

The CAD/CAM software does have some disadvantages, such as a high expense of ownership, time and cost capital on the doctor's side to grasp the method, some challenges in securing high precision impressions for numerous unit prosthesis, and the possibility of construction errors or defective crafting, especially with multiunit dental restorations, which may jeopardise the mechanical characteristics of the generated restoration [3,4].

CAD/CAM software is already a necessary component of modern dentistry [5]. This technology is expected to transform the way dentists work in the future.

CAD/CAM dental refers to the software that allows dentists to complete complicated restorations quicker, better effectively, and often more accurately. Crowns, inlays, onlays, veneers, arches, prostheses, and implant supported fillings are all made from high-strength ceramic using this software in healthcare settings and labs. Here's just what anticipate from a CAD/CAM restoration technique.

Preparation of the teeth by eliminating any deterioration and components of the structurally unstable tooth, your dentist will ready the area for your repair.

Intraoral imaging is a procedure that involves examining the inside of the mouth. The teeth preparation and adjacent teeth will then be digitally captured using an optical scanner to create a 3D bespoke picture.

Design for restoration. The dental practitioner will utilise the cad software to build the final restoration using the 3D pictures.

Milling the crown, veneer, inlay, on-lay, or bridge is then milled from a solid block of ceramic using a grinder.

Hardening and polish are two different processes. Before being polished, the restoration is coloured or coated to make it look better natural. Recrystallization and buffing are two different processes. Before even being polished, the restoration is coloured or coated to make it look more natural [6,7].

Embedded device finally, to finish your smile, the restorative is fixed in place in your mouth. Based on the complexity of the case, the entire process could take anywhere from 45 minutes to an hour. Cadcam, on the other hand, takes lesser time and effort than conventional laboratory approaches.

DISCUSSION

Application of CAD- CAM in various branch of dentistry

CAD/CAM is used in a variety of applications, including restorative dentistry and prosthetics, as well as implantology, oral surgery, including orthodontics.

- **Conservative dentistry**: Indirect fillings like inlays and onlays. Single and numerous fixed prostheses, core inlay, dental veneers, supra-implantary prostheses and even emergency prostheses can all be done with this technique.
- **Prosthodontics**: It can be utilised for removable prostheses as well as detachable implants replacements.
- Specialized software can design complete prosthetic bases and metal partial prosthesis frames for adjoint prostheses, as well as mimic the patient's occlusion on a digital articulator.
- **Maxillo:** Facial prosthesis is also made with it. Each application's production techniques and materials varies, but the digital flow is basically the self-same [8].
- **Endontics:** Implant dentistry, CAD/CAM can be utilised to create unique foundations, implant bars, and implant surgical aid to help guide the surgical operation in implant fixication.
- **Orthodontics:** CAD/CAM in orthodontics has resulted in the creation of a new method for treating malocclusions utilising "transparent" align trays, which offers a substitute to traditional orthodontic therapy. CAD/CAM for orthodontics has developed a number of technology solutions, including Invisalign. This software can save digital models created from optical impressions, arrange treatments with the help of set-ups, and analyse cephalometric data.
- The bonding step is improved with CAD/CAM by creating an indirect bonding tray that can efficiently and precisely imprint the location of orthodontic brackets onto the patient's teeth.
- **Conservative:** All are customary to seeing restorations exhibited on a model even if they have been straight manufactured online and can be employed for traditional components of restoration production, such as placing a veneering layer. Patient replica files can be found digitally and reproduced only when required, reducing storage capacity.
- Osteotomy and repositioning can also be done with CAD/CAM.

Advantage

3D printing has been heralded as a game changing innovation that will revolutionise manufacturing technology that is used in aerospace, military, art and design is becoming a hot topic in healthcare. With developments with 3D modelling and process such as cbct computed tomography and intra-oral scanning, as well as a strong tradition of CAD/CAM use in dental care, the technology will become increasingly relevant. 3D printing uses include screw guides for implants, physical replica for prosthodontics, orthodontics, including surgery, and the production of dental, craniomaxilar, including craniomaxillary implants.

Quick, efficient and simple to use: Optical impressions remove a number of levels in the prosthetic chain, making them quick, efficient, and simple to use. This translates to more effective and speedier operations, reducing time and resulting in a standardized approach

with less need for fine tuning restorations while maintaining stability [9,10].

Productivity and profitability increases: Apart from increased efficiency in the operating room due to shorter manufacture times, direct CAD/CAM reduces the number of procedures to just one. This will assure that the treatment is financially beneficial to the surgeon.

Greater precision, consistency and traceability: Restorations are more precise thanks to the rational procedure proposed by CAD/CAM, which lowers the phases in the prosthetic chain and thus the danger of failure. Moreover, digital can be utilized to maintain medical device uniformity and improve their tracking.

Enhanced therapeutic arsenal: New materials and techniques, such as 3D printing, are now available to physicians, allowing them to diversify the activities and therapies they perform on a regular basis. Trying to master the digital technique requires learning to manage new technologies, their unique characteristics, clear signs, and limitations, and also new work tools such as intra-oral cameras and impression scanners (silicon or alginate), Numerically Controlled Machine Tools (NCMT) and CAD/CAM applications. This allows practitioners to develop their knowledge and skills on an on-going basis.

Improved brand image: Because of the large choice of matter and novel healing options provided by CAD/CAM, dentists can differentiate themselves from the competition by improving their work and the training in addition of their practise, as well as providing their patients with a more present day type of dental care.

For patient's better grade treatments given: Patient comfort: Sufferer can now benefit from restorations that are not only more visually attractive, biosensor and non-toxic, but more precise, thanks to the CAD/CAM process.

Dematerializing jobs across the prosthesis chain eliminates the errors that come with conventional methods. With the introduction of new, novel materials, we now need to set safety and quality criteria for the end result as rapidly as possible to ensure that CAD/CAM restorations are of exceptional quality.

Removing the physical imprint step alginate or silicone, which is generally thought to be too invasive by CAD/CAM patients, provides a lot of advantages. Using only one anaesthesia instead of two and obviating the need for a transition stage are two evident benefits.

Appointments are quicker and more agreeable, and there are less of them; owing to direct CAD/CAM, some treatments can even be completed in one single session, including setup.

Advantages for the prosthetist

Benefits for operation become benefits for the laboratory. The prosthetist receives an instantaneous, extremely accurate digital imprint, which decreases the systematic error that can arise from personalised assessments, producing the entire procedure faster and additional efficient.

Patient practitioner: Patient education is significantly easier thanks to the digital data flow. Information may be multiplied and interfaces can be exchanged using these technologies. In essence, a clear and precise visual presentation using graphics on the screen serves as justification for a certain medical option and treatment strategy. Patients can then negotiate the clour and form of their tooth, as well as the method to be employed, with the clinician. Patients are better able to virtually imagine the eventual result of their treatment and are comforted about the integrity of this treatment when medical jargon is removed. The surgery gains credibility and establishes a trusting relationship.

Product development and instrument production

Doctors in general and dentists in particular, are well-known for their innovation and creativity. Rapid prototyping of instrumentation is made possible by 3D printing, which lets creative people to bring their ideas to life in a short amount of time. While the robotics enables the physician to proceed quickly from notion to mockup fibrication, the actual printing process takes time and expensive when collaborating with materials with useful mechanical characteristics. This may be one reason why the term "3D printing" has caught the public's attention while "rapid prototyping" has not [11].

Disadvantage

Prosthetic teeth and denture bases come in a variety of hues and qualities. The prosthetic tooth must have a greater standard of wear resistance as well as a pleasing look. Cutting prosthetic tooth from a small property block is tough. As a result, just the denture base is shaved, and then easily obtainable fake teeth are glued to the denture base. Special glue with improved adhesion qualities are in the works. Viruses are common at office. Work might be "hacked" simply. Learning how to handle or run programs is a time-consuming task.

CONCLUSION

Despite the earlier advantages of chair-side CAD/CAM systems, we can conclude that the disadvantages of this model include expense, capital and maintenance costs, uncertainty, lack of desire to learn a new concept, refusal to change practising methods, nasty remarks from some peers, a small number of customers, rejecting things that would reduce the practice's stability, and the size of the scanning device.

When computers or equipment fail, it results in costly setup, which is inconvenient for everyone involved. Maintaining a preventative maintenance routine can be beneficial, but breakdowns are unavoidable, which is a drawback.

CAD software often necessitates a significant amount of computer processing power. This necessitates high-end computer technology, which can be pricey. CAM

necessitates the use of expensive modern manufacturing equipment. The high cost of hardware is a fundamental drawback of CAD/CAM and a major impediment to their widespread adoption.

Accuracy-companies can use prototyping to print pieces for functional testing before they go into production. Despite technological advancements, many prototyping techniques are unable to create the design perfectly. Even the most precise 3D printing systems, for example, can produce items with a tolerance of 0.1 mm. While this is nearly flawless in terms of part correctness, the final dimensions of the part are still wrong. Parts with thin walls or delicate patterns are also challenging to create with prototyping methods.

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