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CAD CAM Based Prosthesis

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ABSTRACT

The time in the morning we wake up till we go back to bed at night time, we are surrounded by all digitalized/digital environment and equipments. Our voice is recognized by our music system that plays song for us. Such is an impact of digital world on our life that we are almost totally dependent on them. Hence, the time has come we convert are traditional dental methods into digital ones. This will definitely increase precession of restorations and comfort for our patients. Digitally driven CAD CAM restorations is one such modality that sets us on path to explore, learn and achieve better results and satisfaction in our patients.

Key words: Digitalized environment, Equipments, Traditional, Modality, Precession, Restoration, Explore.

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INTRODUCTION

Restoration in dentistry

Restorations are the clinical procedures by which dentist restores or replaces missing tooth structure and there by re-establishing its normal form and function. There are two types of restoration.

Direct restoration: Restorations that can be entirely fabricated directly inside the mouth during a single dental appointment are called as direct restoration. Amalgam restoration and composite restoration are direct restoration.

Indirect restoration: Restorations which cannot be fabricated within the oral cavity so it is fabricated outside the oral cavity before placing it on the damaged tooth. For fabrication of indirect restoration a positive replica of intra oral structures is required. Step performed by dentist to obtain this replica is making of impression. This impression making is being traditionally done by using impression trays and impression material. Few examples of such restorations are inlays, on lays, crowns and bridges, veneers and dental implant.

Drawbacks of traditional impression making

Traditional impressions making has various drawbacks which include:

Mess: Making of impression is generally untidy. As the dentist is unable to prevent the scraps of material which get stuck around patient's oral cavity, undercuts of teeth or inside the mouth. Also, the material is found on the floor, armamentarium and dental chair making it an unhygienic and dirty process [1].

Unpleasant for the patient: Some patients may feel comfortable with impression material in their mouth, others feel compelled to gag or regurgitate during impression making. Air bubbles or debris present in the impression material causes errors in the cast. Every material reacts differently to bubbles because of its hydrophilic nature. Sometimes bubbles form during cast pouring procedure because of increase in surface tension of impression material which causes many errors. Managing distortion of impression material before pouring the cast is also difficult [1].

Storing of materials and trays: Storing the material used for impression making along with armamentarium like trays and instruments in the dental clinic requires extra attention of supervision increase in the workload [1].

Tray distortion: When a tray comes into contact with teeth or tissue, it may distort, and this is more of a problem with dual-arch trays than full-arch trays due to its design. It is vital to choose a tray that does not come in contact with the teeth and is robust enough to resist distortion [2].

Surface contamination: It resulted in a sticky, unset imprint layer. It could be owing to a greasy coating on the tooth preparation left by core build-up material, composites, or adhesives. Any of these factors can hinder the material from properly setting. Sulphur can be transferred to vital locations by retraction cords and

solutions comprising aluminium chloride or ferric sulphate, slowing the setting reaction of the marginal VPS material. The same effect can be achieved by contacting the retraction cord with gloved fingers, rolling it in gloved fingers, or employing a rubber dam. When mixing by hand, latex can contaminate the putty [3,4]

Poor marginal details: One of the most important components of a dental impression is the margin. Open margins and restorations with improper fitting usually show incorrect impression of margin which mostly occur because of decreased pressure applied during retraction and collection of fluid stops the impression material from adapting around the margin [5].

Internal bubbles: Moisture trapped in the impression substance, such as blood, water or saliva can generate bubbles in the impression. These bubbles may be large enough to interfere with the luting agent, increasing the amount of space that needs to be filled [6].

Marginal tears: When the wash material's rip strength is insufficient, little tears can occur. Material strength varies by manufacturer, and materials with a lower viscosity are more prone to tear in the sulcus. The wash material is thinner when the sulcus is extremely deep, and there is a greater chance of it tearing when removed. Furthermore, removing the impression before the wash substance has fully set may result in some ripping [6].

Choosing the right impression material: For a precise and predictable impression, choosing the correct impression material is critical. In most cases, a sort setup time is preferred for your patient's comfort; but, knowing the working time for the material you've chosen is critical. Within the working time, the impression must be introduced. If it's already set, it's possible that it won't seat properly and won't gather all of the necessary information [5].

Failing to keep the patient still: If the patient moves or starts to gag, the impressions can get distorted [5].

LITERATURE REVIEW

Need of digital dentistry

New technology has advanced swiftly in recent decades, transforming the planet and our daily lives. The digital revolution has immensely enriched our way of life, from smartphones to smart cars. These improvements also have a significant impact on the healthcare profession, which includes dentistry. We are in the midst of a digital dental revolution. Dentistry is being profoundly reshaped by the advent of new digital equipment and processing software, as well as beautiful materials and sophisticated manufacturing techniques. The introduction of 3D intraoral scanners is one of them, and it is revolutionising dentistry. These changes have improved both dental professionals' and patients' entire experiences, enhancing services and care in ways we never envisioned. More and more dental clinics and labs are seeing the value of going digital these days. Practices that embrace digitalization will eventually reap significant benefits in terms of outcome quality, cost, and time savings [7].

In contrast to employing simply electrical or mechanical equipment, automated dentistry involves dental techniques or gadgets that used automated or procedures that are managed by computer. The goal of automated dentistry is to provide productivity and correctness of dental procedure while providing expected results. The advancements in imaging, manufacturing, and software integration assist dentists in their efforts to give the finest possible care in the most pleasant environment. In this sense, digital revolution is irreversible, with new, quickly evolving, minimally invasive procedures gradually replacing traditional ways [7].

From two and a half decades, CAD CAM is progressively becoming popular [8]. Both dental labs and clinics take benefit from this technology as it can be used in full mouth reconstruction, inlays, on lays, veneers, crowns, FPD and implant. In orthodontics, CAD CAM is also used. This technology addresses three issues [9,10]

- Ensuring strong repair for the teeth especially for the posterior ones.
- To make aesthetically natural looking restorations.
- To make restoration easier, faster and more accurate [11].

CAD CAM'S workflow

CAD/CAM's components are scanner, design software and processing device.

Scanner: This term in dentistry refers to information storing instruments to assess three-dimensional intra oral features then converting into automated sets of data. General scanning options available are:

- 'Optical' scanners.
- 'Mechanical' scanners [12].

Optical scanner: Triangulation technique is formation of scanner that collects 3D structures. An acute angle is formed between the arrangement of receptor unit and the light source (e.g. laser). At this angle computer derives a three-dimensional set of data using the image formed on receptors. Illumination sources that can be used are either projections from white light or beam of laser.

Examples of such scanner used in dentistry are:

- 3M ESPE, white light projections (Lava Scan ST)
- KaVo, white light projections (Everest Scan) [13].

Mechanical scanner: In this scanner the measurement of 3D structure by reading the final cast in a line by line manner mechanically using a ruby ball.

Examples of such scanner used in dentistry are: Nobel Bio care (Goteborg) Procera Scanner.

Advantage of this scanner is that it shows high accuracy of scanning since the ruby ball has an adjustable diameter which can be adjusted in the milling system

with smallest grinder, allowing milling of every data that the systems collect.

Disadvantage of this scanner is that it is very expensive because of its overly intricated techniques and takes larger duration of time for processing when compare to an optical system [14,15].

Design software: Manufacturers provide special software for designing of many types of restorations used in dentistry. On one hand, such software can be used to create framework for FPD (Fixed Partial Dentures) and crown; on other hand, certain systems allow designing of inlays, FPD retained by inlays, partial crowns, adhesive FPDs, anatomical crowns and telescopic primary crowns to the users. The CAD CAM system's software which is now present in the market is upgrading constantly. Updates ensure that the user has access to the most up-to-date construction options. Various formats are being used to save the data constructed [16].

Processing device: CAD software's construction data is translated into strips of milling for the CAM procedure before being put into milling machine [12]. Devices used for processing are differentiated by means of number of milling axes present.

- 3 axis devices
- 4 axis devices
- 5 axis devices

Application of CAD CAM

Removable partial denture: Surveying the cast digitally to identify required and unwanted undercuts and producing virtual patterns of the removable partial denture's frameworks are two key advantages of employing CAD CAM and 3D technology printing in the manufacture of removable partial dentures. Modification of scaling factor for compensating of the shrinkage that occurs during casting could be put into software as a quality control component.

In recent times a lot of CAD CAM software is being used commercially and is more available for framework designing of RPDs, physical 3 dimensional elements are produced by an additional technology called RP technology. The final pattern printed is either casted using traditional method or directly in metal alloys. The novel technology has potential to improve the fit of RPDs while also saving labour in the dental laboratory. Reduced fabrication time, enhanced quality assurance concerns, and greater fit are all touted benefits of using automated technology in the field of removable partial prostheses [17].

Inlays and Onlays: In this system the computer is attached to a tiny milling machine which precisely grinds the restorations of ceramic to enable its fitting in a prepared cavity. A miniature infrared video camera which can transmit pictures to a screen for the ease of use enters this information about the prepared cavity into the computer.

Prior to milling dentist can or cannot adjust the restoration designing as it is mostly automatic. After complete satisfaction of the practioner with the design, the automatic milling machine grinds the master restoration using a ceramic material block. A maximum of 10 minutes duration is required for the restoration to get completely ready for its proper bonding intraorally. This technique has many advantages over the traditional methods because the complete process from the preparation of the cavity to the bonding of material is done in a single sitting, thus skipping the various in between procedures like impression making which causes a loss of minute details, cast preparation and articulator mounting as the occlusion adjustment is done intraorally. Thus, ignoring a lot of laboratory work. Also, problems which occur between two appointments like sensitivity and micro leakage are ignored. It also shows an improvement of restoration fitting internally and on margins [18-20].

Crown and bridge: CAD CAM porcelain crowns are very useful clinically as they do not have technique sensitive builup processes thus are easy to manipulate. Also they have features like conventional staining glazing techniques and add ones. Therefore they are very user friendly. They also promise excellent, aesthetics and fit, very strong durability with adhesive resins cement and faster fabrication. The only drawback is that they can be used only for single crowns [21,22].

Orthodontic appliances: The orthodontic appliances formed by CAD CAM technique has a major role of improve results. Various components like virtual treatment planning, precisely mild indirect bonding jigs and personalised brackets together contribute to proper movement of tooth. Thus, decreasing the chances of manual errors of the orthodontic treatment, it is accountable for anatomic differences in the shape of tooth and improved quality of orthodontic treatment in all aspects. Another important matter of consideration while the treatment planning is the duration of treatment, the direct bonded treatment takes 8 months more than the computated treatment. This difference of duration is about 36% which is helpful for both doctor and patient. The indirect bonded treatment takes 3 month more than CAD CAM treatment [23].

DISCUSSION

There is no denying that dental treatment methods and materials have improved over the past 50 years, particularly in the areas of prosthodontics and restorative dentistry. Therefore, effective use of innovative materials and novel technologies will be crucial for dental care in the future. We believe that CAD/CAM technology will significantly aid in patients' healthy ageing. One major goal of CAD/CAM appliances is to improve the final outcome. The benefits of digital technology in the field of dentistry include reduction in fabrication time, better quality and improved fit. Over the next decade, as prices fall and dentists gain confidence with the new technique, we can expect to see increased use of CAD/CAM in dentistry. Scanning, design, and

milling devices are predicted to become more simple and user friendly. Dentists are expected to provide their customers with affordable, aesthetically pleasing tooth colored restorations in only one session.

CONCLUSION

The dentistry has risen to the standard. Where patient need not to follow multiple appointments for his restorations. This digital advancement discussed threw light on generalised applications of CAD CAM in dentistry. These trends will definitely help dental profession and its services to general public to achieve better standards. This science has no limit for its application in dentistry but it is up to us, as clinician to remain updated with pace of science.

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