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REVIEW ARTICLE

Comparative study of Interim Materials and CAD/CAM systems: a Literature of Review

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ABSTRACT
Prosthodontic treatment sometimes requires a long-term interim fixed dental prosthesis (FDP) until the definitive restoration can be cemented. However, some interim materials are weak and do not have an adequate marginal seal. The CAD/CAM systems have developed considerably, offering accuracy and more options than previously. It can be envisioned that CAD/CAM technology developments will continue to offer dentistry more options for its use, including further CAD/CAM integration of procedures and imaging enhancements. With the advent of new interim crown materials, it has become imperative to evaluate its strength in order to select the appropriate interim crown and partial fixed dental prosthesis material. However, there is lack of information on marginal gap and fir of interim materials using CAD/CAM systems. So, this review paper studied the comparative study of interim materials and CAD/CAM systems using the PubMed and Medline database for recent history. The aim of this literature review was to provide useful information prosthodontics.
Keywords: *Interim materials, CAD/CAM*

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INTRODUCTION

A provisional restoration functions as an interim restoration from the time the tooth area is prepared for restorative procedures until the final prosthesis is cemented in place in the mouth [1]. While the terms provisional, interim, or transitional restoration have been routinely used interchangeably in the literature, the use of the term temporary is controversial and is considered inappropriate by some because interim restorations serve many functions, and "temporary" treatment may be interpreted as one of lesser importance or value [2].

Fixed prosthodontic treatment, whether involving complete or partial coverage and natural tooth or dental implant abutments, commonly relies on indirect fabrication of definitive prostheses in the dental laboratory. Historically, the necessity for provisional treatment has been primarily derived from this methodologic process. The importance of interim treatment, however, is more far-reaching than is portrayed by this procedural necessity and the requirements for satisfactory provisional restorations differ only slightly from the definitive treatment they precede [9]. Little research has been published comparing the efficacy of the marginal fit and fracture strength of direct interim long-term fixed prostheses relative to those fabricated with the CAD/CAM technique [4]. Therefore, the main objective of the present study was to determine interim materials and CAD/CAM systems using the PubMed and Medline database.

CAD/CAM SYSTEM

The computer-aided design/computer-aided manufacturing (CAD/CAM) technology offers the possibility to produce dental restorations by means of numeric controlled machining [3]. The many benefits associated with CAD/CAM-generated dental restorations include: the access to new, almost defect-free, industrially prefabricated, and controlled materials; an increase in quality and reproducibility and also data storage commensurate with a standardized chain of production; an improvement in precision and planning, as well as an increase in efficiency [4]. CAD/CAM technology can be employed for the fabrication of permanent restorations, as well as temporary restorations to be milled from industrially produced blocks [5]. One of the benefits of this very mature system is the software that has been supplemented by a very exact three-dimensional reconstruction of the occlusal surface [5]. In recent years, CAD/CAM production has clearly expanded the palette of materials for dental prostheses by providing access to new ceramic materials with high dependability. Different digitizers such as a contact probe, laser beam with a PSD sensor, and a laser with a CCD camera were developed. Sophisticated CAD software and compact dental CAD/CAM machines were also developed. Consequently, both metallic and ceramic restorations were able to be fabricated by the second generation CAD/CAM systems [8].

The interim restorations

It can be challenging for practitioners to justify the use of provisional treatment because of its "temporary" nature, especially when the time required producing a suitable interim restoration equals that spent for tooth preparation and impression making [9]. However, the exclusion of this essential step and the quality of the provisional restoration can be the difference between overall treatment success and failure [10]. The terms provisional, interim, or transitional have been routinely used interchangeably in the literature. The use of the term temporary, however, is controversial and is considered inappropriate by some because provisional restorations serve many functions, and "temporary" treatment may be interpreted as one of lesser importance or value [11]. Provisional restorations should be the same as definitive restorations in all aspects, except for the material from which they are fabricated [10]. Provisional treatment as an adjunct to some procedures such as porcelain veneers or implant prosthodontics may be occasionally unnecessary [10].

Interim prostheses are used to protect pulpal tissues, protect abutments after preparation, evaluate parallelism, prevent the migration of abutments, and improve esthetics in anterior areas [12]. Moreover, interim prostheses could assist with periodontal therapy, orthodontic therapy, occlusion treatments, and implant therapy [13]. Ideally, interim prostheses should have sufficient strength, good marginal accuracy, and a low rise in exothermic temperature during fabrication; they should not cause irritation; and should be easily fabricated or repaired [14].

INTERIM RESTORATIONS IN CAD/CAM DENTISTRY

CAD/CAM technology can fabricate interim restorations as well as permanent restorations [6]. Using computer-aided design/ computer-aided manufacturing (CAD/ CAM) to fabricate interim prostheses is of interest because CAD/CAM interim treatments use optical impression making that avoids patient discomfort. Moreover, CAD/CAM interim materials are prefabricated from industrially polymerized blocks, which prevent the heat of polymerization and shrinkage [14]. Alt et al [15] found that composite resin-based CAD/CAM materials offered mechanical-strength advantages over PMMA-based materials. Basaran et al [16] reported that fiber-reinforced CAD/CAM composite resin blocks showed higher load-bearing capacities. Stawarczyk et al [17] reported that commercially polymerized resin CAD/ CAM crowns presented significantly lower tensile strength and lower wear on enamel antagonists than those of glass ceramic crowns, which makes them a possible choice for long-term use.

MARGINAL FIT OF INTERIM CROWN

The marginal fit of an interim crown should be as precise as the definitive restoration to prevent irritation or inflammation of the periodontal/pulpal tissues and to ensure an esthetically satisfactory outcome. However, interim materials exhibit marginal discrepancies caused by the reduced atomic distance of the monomer molecules during polymerization [6]. This discrepancy depends on the monomer used in the interim material [7]. Shrinkage is associated with dimensional changes and internal stresses which inevitably affects the precise fit of the temporary restorations. The clinical outcome may involve marginal discrepancies and occlusal interferences as the temporary crown cannot be seated correctly [20]. Apart from the crown margins (gap-free transition between tooth and crown, smooth surfaces), which are of paramount importance to the health of the surrounding periodontal tissue, a tight marginal seal is essential to the health of the tooth [20].

Hence, monomethacrylate-based materials show significant shrinkage during polymerization because of the low molecular weight of the monomers involved. Marginal discrepancies below 120 mm are considered clinically acceptable [8]. In a study, Yao et al. [18] studied comparison of the flexural strength and marginal accuracy of traditional and CAD/CAM interim materials before and after thermal cycling. According to their results, CAD/CAM interim materials were stronger and had better marginal accuracy properties than bis-acryl materials, especially after thermal cycling. Balkenhol *et al.* [19] investigated correlation between polymerization shrinkage and marginal fit of temporary crowns. They observed shrinkage values are not suitable to predict the marginal accuracy of a temporary restoration. At least 30 min should elapse between fabricating and trimming temporary crowns to avoid further inaccuracies.

FRACTURE RESISTANCE OF INTERIM CROWN

Temporary restorations can be either fabricated in the clinic or laboratory environment by using polymethylmethacrylate resin and bis-acryl composite resin materials or by using a pre-fabricated polycarbonate form. The preparation of temporary crowns using different fabrication methods with auto polymerizing and heat-polymerized PMMA resins and bis-acryl composite resins has been described by various researchers, and the fracture strength of these materials has been tested [21].

Provisional materials generally exhibit low fracture strengths, particularly when the patient must use the provisional restoration for an extended period, when the patient have parafunctional habits, or when long-span prosthesis is planned [22]. Resistance to functional load and removal forces which are mechanical factors must be considered when choosing a provisional restorative material for clinical use [23]. The mechanical properties of the provisional materials can be influenced by saliva, food components, beverages, and interactions among these materials in the oral environment [24]. Therefore, their integrity must be preserved throughout the treatment period.

The flexural strength of interim prostheses is a critical property, particularly in long-span interim prostheses with short height pontics and connectors [6] and when the patient exhibits parafunctional habits such as bruxism and clenching. Flexural strength is also important when these restorations are worn over a long period of time to assess the results of periodontal, endodontic, and temporomandibular joint dysfunction therapies and during the restorative phase of implant reconstructive procedures [25]. In a study, Yanikoğlu [26] reported all bis-acryl resin composite materials exhibited high fracture strength over the traditional methyl methacrylate resin throughout the 14 day time interval of investigation. The different solutions have not statistically significant effect on the flexure strength values on four materials temporary.

CAD/CAM technologies, which are used to fabricate temporary restorations, may solve some of these issues; resin-based blanks cured under optimum conditions exhibited increased mechanical strength and prevented porosities within the restorations. In addition, CAD/CAM-fabricated temporary restorations reportedly reduced the chairside time and produced superior results [27]. Little research has been published comparing the efficacy of the marginal fit and fracture strength of direct interim long-term fixed prostheses relative to those fabricated with the CAD/CAM technique [4]. In the present study was to determine interim materials and CAD/CAM systems using the PubMed and Medline database. We hope, this paper provide information for interim materials and CAD/CAM systems. However, this paper provides useful information for interim materials application in the dentistry.

CONCLUSION

We hope, this paper provide information for interim materials and CAD/CAM systems. However, this paper is part of our main study on marginal gap and fracture strength of three-unit interim FPDs fabricated by two CAD/CAM systems and direct with different materials.

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