Marginal fit of two CAD/CAM Restorations Using Different Impression Materials

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Ezzeddin ragab alhur

Dedication

This work is dedicated to

♥*The my father, my lovely mother, my brothers ,*

and my sisters

The light that leads my way♥

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Introduction

Impression material is used to record the intraoral structure. Ideally the material should be extremely accurate, and virtually distortion free. The accuracy allows to record minute details without taking additional impression. The material is very soft elastic & resistance to tear while removes from the undercut.[1]

Prosthetic restorations that fit poorly may affect the periodontal health and occlusion. The design of the tooth preparation is an important consideration in tooth reconstruction. The use of certain geometric features in preparations for full coverage restorations has been based largely on experience and individual preference.[2]

The dimensional changes of the impression materials may affect the quality of fit and retention of the restoration, which influence the success of indirect restorative procedures.[3,4,6] The dimensional behavior of impression material, is influenced by humidity, the time interval from mixing to pouring, and the thickness of the layer of material in the tray. In addition, impression materials contract with the temperature change from the oral cavity to the external environment due to their linear expansion thermal coefficient[3].

Dental clinicians have remained suspicious about the structural longevity, potential abrasiveness and accuracy of fit of ceramic restoration. These concerns have directly influenced the development of new materials and laboratory processing systems. The recently introduced ceramic

materials were claimed to possess high strength properties thus allowing the fabrication of anterior and posterior all ceramic crowns.

The marginal fit of dental restorations has a key role in their success. Failure to provide good marginal fit can lead to plaque accumulation and periodontal breakdown, recurrent caries, and, ultimately, the failure of the restoration.[8] Different investigators have compared the marginal fit of commonly used ceramic restorative systems, with varying results.[9]

Many commercially available inoffice and laboratory CAD/CAM systems have been introduced. These systems can fabricate anatomic contour restorations and also copings for ceramic veneer application. Several studies have reported that the marginal fit of CAD/CAM restorations is dependent on different factors that include margin configuration, die space thickness, the type of cement used, and the cementation technique. [10] Suggestions that scanning, software, and machining have a detrimental effect on the fit of CAD/CAM restorations have also been made.[11]

New generation of impression materials keep immersing in dental market every day, so more investigations are needed to study their properties and qualify their uses.

This study was conducted to evaluate which of these materials could provide accurate seating of the final restoration.

Review of Literature

The selection of restorative materials is based on a combination of clinical requirements and material properties. A dentist commonly balances esthetics with strength and fil for materials in fixed prosthodontics. Although metal ceramic restorations can often fulfill technical requirements, esthetics can be insufficient. In certain clinical situations, a translucent restoration is required and call only be achieved with an all-ceramic material[(12)].

Impression materials are used to register or reproduce the form and relations of the teeth and the surrounding oral tissues[(5)]. Over the past few decades, tremendous progress has been made in both impression materials and procedures for making fixed prosthodontics impressions[(48)]. As a result for constants advancements in impression materials, making impressions to duplicate oral conditions and tooth morphology is an integral part of prosthetic dentistry which quality guarantees the long term success and prognosis of the prosthesis itself [(6)].

The most important characteristics of impression material include high accuracy, exact reproduction of details, controllable dimensional changes, good flow ability, easy removal and handling. Clinically, there are many kinds of impression materials available for dental use Generally, they can be divided into two large groups: (1) Synthetic elastomeric impression materials that include Polysulfide, Condensation Silicone, Addition Silicone and Polyether. Silicone impression materials are the most acceptable in this group. (2) Hydrocolloid impression materials this group includes Agar Agar and Alginate impression materials, the latter being more popular. Clinicians are not agreed which of these two groups is better but, because Alginate is

cheaper than other materials, it is hoped that it may become the material of choice.

Accuracy and dimensional stability of impression materials have been the traditional goals of researchers and clinicians. Due to a host of contingencies, many dentists do not pour their own impressions immediately. Thus, impressions must be stable enough to produce accurate casts over extended periods of time. This need for a more stable, accurate, and elastic impression material sponsored the introduction of elastomers into dentistry.

1. Elastomeric Impression Materials:

The elastomeric impression material was developed as an alternative to natural rubber during World War II. These materials have since been modified chemically and physically for use in dentistry. Initially, this group consisted exclusively of Polysulfide impression materials. Subsequently Condensation-cured Silicones were developed. Today the most popular Elastomers used in dental practice are the Polyethers and Addition- Reaction Silicones, or Vinyl Polysiloxanes[(49)].

Elastomeric impression materials are often used to reproduce soft tissues, the dental arch, and teeth which have been prepared for indirect laboratory restorations. There are many commercially available products which fulfill criteria such as nontoxicity, ease of handling, appropriate accuracy, good detail reproduction and dimensional stability[(1)].

1.1.Polyethers

Polyethers had been introduced to the markets since the late 1960. It consists of a base paste that is composed of a long-chain polyether copolymer with alternating oxygen atoms and methylene groups and reactive terminal groups. Also present are fillers, plasticizers, and triglycerides. The catalyst paste has a cross-linking agent, filler and plasticizers. Polyethers involve the reaction of the polyether-containing imine ringed side chains with a reactant that opens the rings and causes chain lengthening and cross-linking to form a polyether rubber[17,44].

Polyether impression materials are moderately hydrophilic and capture accurate impressions in the presence of some saliva or blood. Because their wetting angle is low, they capture a full arch impression easier than with polyvinyl siloxanes. Their ability to reproduce detail is excellent and they are dimensionally stable and allow multiple pours of accurate casts for 1 to 2 weeks after impressions are made, provided there is no tearing of the impression. They do not tear easily, which enables the dentist to get good subgingival detail without tearing the impression on removal. [17,44]

Polyether has properties such that it can flow into critical areas with low pressure exerted, which results in accurate impressions and makes for fewer adjustments and remakes for the practice of dentistry. They are a superior material to hydrocolloids and some what better than polyvinyl siloxanes[17]. Because these materials are moderately hydrophilic, strict attention to disinfection guidelines is necessary to prevent swelling of the material [23].

Polyethers do taste bitter, although it is currently flavored to offset the taste. The setting times are relatively short (4–5minutes), and the set is not

altered or contaminated by latex gloves. It adheres to itself and can be used to border mold or make correctable impression techniques [21].

Improved polyether formulations such as the ‘‘soft’’ polyethers had been introduced to the market which are easier to remove, maintain proper rigidity for a wide range of applications, and capture fine detail even in moist conditions [24].

1.2.Addition silicones

Addition silicones are the most popular because no reaction byproducts are formed. Its reaction involves the linking of a vinyl siloxane in the base material with a hydrogen siloxane via a platinum catalyst [17,42].

The reaction produces hydrogen, which is scavenged by the platinum. Viscosity is altered by changing the amount of silica filler, which produces either a putty or less viscous wash material. Vinyl polysiloxane silicones are considered state of the art for fixed partial denture impressions. They constitute the most widespread use of impression materials for fixed prosthetics [42].

Addition Silicones (Polyvinyl Siloxanes) have a moderately low-molecular weight Silicone that contains silane groups. Since Addition Silicones do not produce a volatile by-product during polymerization, very small dimensional changes occur on setting. Hydroxide groups in many products produce hydrogen gas, resulting in small bubbles on the model surface if pouring is not delayed by 30-60 minutes. Many of these Addition Silicones contain catalysts like palladium that absorb this hydrogen. Newer Addition Silicones have been formulated to be more hydrophilic[47].