Dimensional accuracy of two impression materials regarding impression technique and pouring time using CBCT analysis

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Dedication

This work is dedicated to

My Dear parents, my wife
My brothers and sister

The light that leads my way

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دقة الإنطباق لمادتي طبع بما يتعلق بتقنية الطبع وتوقيت الصب بإستخدام الأشعة المقطعية المخروطية

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مدرس بقسم التيجان والجسور
كليه طب الاسنان
جامعة عين شمس


﴿رب أوزعني أن أشكر نعمتك التي
أنعمت علي وعلى والدي وأن أعمل
صالحا ترضاه وأدخلني برحمتك في
عبادك الصالحين﴾
النمل:١٩

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INTRODUCTION

Elastomers are rubber-based materials used for dental impressions taking that can be classified into four groups according to the polymer constituent:

Poly sulfide (PS), polyether (PE), polyvinyl siloxane (PVS) and condensation silicone (CS). Poly sulfides present high tear resistance, good reproduction of details, and low cost. Poly ethers exhibit intermediate tear resistance, excellent detail reproduction, and high cost. PVS provides excellent tear strength, a good working time, and excellent elastic recovery, whereas condensation silicones have low tear strength and demonstrate greater distortion [(1)].

An ideal impression material should present, among other characteristics, dimensional stability over long periods, which allow the production of precise cast models at any time. However, the materials commonly used in dental impressions present alterations in their dimensional behavior. The release of water and ethanol as by-products of the polymerization of polysulfide and condensation silicone, respectively, and polyether hydrophilic behavior may affect their dimensional stability. Due to the absence of by-products in PVS polymerization, it presents the most favorable dimensional behavior [(1-5)].

The dimensional changes of the impression materials may affect the quality of fit and retention of dental prostheses, which influence the success of indirect restorative procedures [(4,6-10)] .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 [9, 11].

Volumetric changes are also related to the type of tray, the degree of adhesion between the tray and materials, and the type of polymer comprising the elastomers [11]. The impression technique can be performed using single or double steps, which can lead to different outcomes with respect to the dimensional accuracy [8, 12].

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

REVIEW OF LITERATURE

Impression materials are used to register or reproduce the form and relations of the teeth and the surrounding oral tissues [13]. Over the past few decades, tremendous progress has been made in both impression materials and procedures for making fixed prosthodontics impressions [14]. 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].

1. Elastomeric Impression Materials:

A variety of dental impression materials currently exist, the majority of which originated for use in non dental fields. One such group is the non-aqueous elastomeric impression materials, or elastomers, which were developed as an alternative to natural rubber during World War II. These materials have since then been modified chemically and physically for use in dentistry. Initially, this group consisted exclusive of polysulfide impression materials. Subsequently condensation cured silicone were developed. Today, two of the most popular elastomers used in dental practice are the polyether and addition silicones or vinyl polysiloxane [15].

All types of elastomeric impression materials undergo shrinkage caused by polymerization, and materials with reaction byproducts undergo additional contraction. The polysulfide and condensation silicones have the largest dimensional change during setting, in the range of ⁻0.4% to ⁻0.6%.

The shrinkage is the result of the evaporation of volatile byproducts and the rearrangement of the bonds with polymerization. The addition silicones have the smallest change, approximately ⁻0.15%, followed by the polyether, approximately ⁻0.2%. The contraction is lower for these two products because there is no loss of byproducts [16, 17].

1.1. Polysulfides:

Polysulfides are also called thiocols or "rubber base" supplied as two paste systems. The cross linking of polysulfides is brought about by the polycondensation in which water is the reaction product. Some polysulfides may be categorized as a toxic substance, primarily due to the heavy metal (lead) oxides contained in the reactor paste [18].

The base consists of a polysulfide polymer (terminal chain/side chain-SH groups), titanium dioxide, or silica. The accelerator (catalyst) is primarily lead dioxide. The viscosity is altered by adding different amounts of titanium dioxide powder to the base. It sets by oxidation of the–SH groups, which results in chain lengthening and cross-linking, giving it its elastomeric properties [17, 19].

Polysulfide impression materials are generally low to moderately hydrophilic and make an accurate impression in the presence of some saliva or blood. Because the material has a low wetting angle it makes a full arch impression easier than with polyvinyl siloxanes or polyethers. It reproduces detail with excellent results but its dimensional stability is only fair [19, 1]. It generally captures a sub gingival margin upon impression without tearing on removal, which is much better than hydrocolloids or poly vinyl. It distorts from disinfection if not performed correctly because of its hydrophilic nature and may swell if placed in water or disinfectant for a period of time [17, 20].