Effect of incorporation of a bacterial inhibitor into Calcium Hydroxide as temporary cement on antibacterial activity and retention of provisional crowns

(An in vitro study)

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Dedication

*To my great **Father**, who was the reason for where I am today, and without his support and encouragement, this work would have not been possible.*

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INTRODUCTION

Along the way, the dentist utilizes a variety of treatment methods to ensure patient comfort and interim stabilization of the restored areas. In fixed prosthodontics the role of provisional restorations cannot be overemphasized. Provisional restorations help to maintain comfort and stability of the restored abutments. Vital teeth are protected and treating dentist is able to evaluate the occlusal design and stability before the definitive restorations are delivered. Provisional restorations have been described as the blueprints for definitive restorations. Well-designed provisional restorations will maintain patient comfort and stability during the treatment phase and will serve as a guideline for the design of the definitive restorations from a functional and esthetic standpoint.

Provisional and permanent restorations may be placed with provisional cement for an extended period especially in cases of oral rehabilitation. Since provisional crowns luted with provisional cements are susceptible to cement washout, marginal leakage, bacterial infiltration, and caries, especially when placed for longer than a few weeks, the luting agent should also have good mechanical properties, low solubility, and good adhesion to resist bacterial and molecular penetration.

Permanent and provisional restorations cemented with temporary cement need to provide biologic and mechanical protection for the abutments. A temporary cement must be strong enough to retain the restoration but weak enough to enable removal of the restoration without damage to the abutment.

Protection of the prepared tooth while the prosthesis is being made is important for the long-term success of the therapy. Freshly exposed dentine is initially protected by the provisional restoration. After properly disinfecting and sealing the dentinal substrate, it is fixed by means of a provisional cement, which gives retention and a certain degree of marginal seal.

A temporary cement with good retentive qualities and antibacterial effect is required for use with the long term provisional restorations.

Chlorhexidine is well-known for binding to buccal epithelial cells, proteins (mucin and albumin) and teeth (hydroxyapatite),a phenomenon which explains its long period of retention in the mouth. Once released into saliva, chlorhexidine is in equilibrium with the matrix of the saliva, consisting mainly of mucin, albumin and some salts. This interaction is very important because only the free concentration is available for antimicrobial effect.

In an attempt to protect teeth from bacteria, studies have examined the possibility of adding antibacterial agents to dental materials. Chlorhexidine added to restorative dental materials to enhance its antibacterial properties has received much attention. Chlorhexidine is a highly effective, broad-spectrum anti-microbial agent. Since chlorhexidine has a strong cationic activity, it is absorbed into the bacterial cell wall, which is negatively charged, causing its disruption.

Consequently this study aimed at studying the effect of incorporation of a bacterial inhibitor(CHX) into Calcium hydroxide as temporary cement on antibacterial activity and retention of provisional crowns.

REVIEW OF LITERATURE

Clinical situations may dictate the need for long-term provisional restorations. During the initial treatment phase, periodontic, orthodontic, or diagnostic procedures may be required prior to the definitive restorative phase. Therefore, provisional restorations may be placed with provisional cement for an extended period. Since provisional crowns luted with provisional cements are susceptible to cement washout, marginal leakage, bacterial infiltration, and caries, especially when placed for longer than a few weeks, the luting agent should also have good mechanical properties, low solubility, and good adhesion to resist bacterial and molecular penetration.

The most important function of temporary cement is to provide a seal, thus, preventing marginal leakage and pulpal irritation. The retentive requirements for temporary cement are to be only strong enough to retain the provisional restoration but allow easy removal of the crown when necessary, and not become more retentive over time. Little is known regarding temporary cement retention. Although there is a strong relationship between the compressive strength and retentive properties of temporary cements, other cement properties, such as film thickness, play a role. Aging has also been shown to decrease the retentive properties of some temporary cements. It was once thought that a thinner consistency mix would result in greater retention as the cement would be able to flow into the surface irregularities of both the tooth and restoration. By modifying the powder/ liquid ratio of the powder/liquid-type cements or by the addition of a modifier to the paste-type cements, it is possible to alter their compressive strength and retentive properties.

Ideal luting agents (permanent and temporary) should have suitable mechanical properties, physically stable and the most important should have antimicrobial activity. It should be obvious that no such ideal product exist. Different types of temporary cements were used in dentistry. [1]

A .*Provisional Luting cements:*

Retentive strength:-

Zinc-oxide eugenol cement:

Zinc oxide eugenol (ZOE) cements were introduced in 1980's. The powder is mainly zinc oxide and the liquid is eugenol with olive oil as a plasticizer. Cements based on zinc oxide and eugenol cause virtually no pulpal inflammation as long as they make no direct contact with the pulp although it has a sedative action on tissues. They have long been used as temporary cements. Attempts have been made to create more biocompatible permanent cements by adding o-ethoxy-benzoic acid (EBA) to zinc oxide eugenol and by reinforcing it with aluminum oxide and poly (methyl methacrylate).Zinc oxide eugenol cements are still used largely for provisional cementation. Combining zinc oxide and eugenol (contained in oil of cloves) forms zinc oxide eugenol which can be used as a filling or cement material used in dentistry. It is classified as an intermediate restorative material and has anaesthetic and antibacterial properties. It is sometimes used in the management of dental caries as a "temporary filling". classification- according to ADA specification no. 30 Type I temporary cementation Type II permanent cementation Type III temporary filling material and thermal insulation and Type IV cavity liners.

Eugenol free cement:

It has been used as eugenol cause polymerization retardation, which cause rubbery consistency especially when used with polymer based temporary crowns. Many studies revealed that eugenol affect bond strength of post and permanent restoration especially if cemented with resin cement.

Calcium hydroxide:

It is a chemical compound with the chemical formula $Ca(OH)_2$. It is a colourless crystal or white powder or even as two pastes. Calcium hydroxide is a low strength base that can be used as a liner, intermediary base or pulp-capping agent. They are supplied as two pastes: a base, and a catalyst containing calcium hydroxide and zinc oxide. Recently many studies revealed that calcium hydroxide can be used as temporary cement. These studies compared the mechanical properties of other known temporary cements with calcium hydroxide and found that calcium hydroxide is better. It is known that calcium hydroxide is highly alkaline which make it bactericidal as it can lower the PH of acids produced from micro-organisms.

Lewinstein et al, in 1992[2] studied the effect of fluoride varnish (Duraphat) on the retentive strength of provisional crowns luted with various temporary cements. They found that applying Duraphat varnish to the tooth surface before cementation enhanced the retentive strength of Tempbond, weakened the retention of Freegenol, but had no effect on Opotow cement. A "transfer effect" was observed, inasmuch as the Duraphat varnish encouraged adherence of the cement to the tooth structure rather than to the temporary crown.

Baldissara et al, in 1998[3] evaluated the marginal microleakage of 4 provisional cements, a cavity base compound and a zinc-phosphate luting cement in provisional acrylic resin crowns fixed on extracted human teeth. A high dye penetration in the tooth/cement interface was present in all 4 provisional cements. They concluded that all materials tested demonstrated different degrees of microleakage. Zinc-phosphate and cavity base compound