Scholars Journal of Dental Sciences
Abbreviated Key Title: Sch J Dent Sci
ISSN 2394-4951 (Print) | ISSN 2394-496X (Online)
Journal homepage: https://saspublishers.com/journal/sjds/home

OPEN ACCESS

Status of Fixed Prosthodontics on Contemporary Luting Agents

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| **Received:** 02.03.2019 | **Accepted:** 05.03.2019 | **Published:** 30.03.2019
DOI: 10.36347/sjds.2019.v06i03.007

Abstract **Review Article**

Several types of luting agents are available with unique properties and handling characteristics. Selection of luting agent is one of the key factors to achieve a successful restoration and will greatly increase the chances of long-term success of the restoration. Newly formulated dental cements have been developed with the claim of better performance compared to the traditional materials. Selection of suitable dental cement for a specific clinical application has become increasingly complicated, even for the most experienced dentists. The purpose of this article is to provide a clinical perspective of luting cements that are currently available.
Keywords: dental cement, luting agents.

Introduction

Luting agents may be permanent or temporary depending up on the longevity of the restoration. Different materials came into existence based on different clinical conditions. The selection of the wrong luting agent affects the indirect restorations longevity. Previously, with the limited luting agents it was difficult to predict the best luting agent but, with advancement in material sciences, clinician got chance to explore newer cements. It made clinician's position critical to choose the definitive material. So, the clinician should have a thorough knowledge about all the newer cements and its properties and use according to the clinical needs. The present article reviews the status of contemporary luting agents, their composition, properties with their advantages and disadvantages from the literature.

Glass ionomer cement

Glass ionomer cement (glass polyalkenoate) was developed by Wilson and Kent in the year 1969, by late 1990's it has become most widely used luting agent. It is the generic name of a group of materials based on reaction of silicate glass powder and polyacrylic acid. This material acquires its name from its formulation of a glass powder and an ionomer that contains carboxylic acids. In its initial stages of development this cement was recommended in restoring teeth with class III and V cavity. It's adhesive bond to tooth structure and its caries preventing potentials made GIC a widely used luting agent. Other uses of GIC includes orthodontics bracket adhesives, pits and fissure sealants, liner and bases, core build-up and intermediate restoration. The type of application depends on the consistency of the cement. This material has a longer working time and is less sensitive to moisture during setting. It is available in powder and liquid, precapsulated form.

GIC powder is an acid soluble calcium fluoroalumino silicate glass and lanthanum. Liquids of GIC was aqueous solutions of polyacrylic acid in a conc. Of 40%-50%. These acids decrease the viscosity and reduce the tendency for gelation. Tartaric acid is added to increase working time, but it shortens setting time.

To extend working time of GIC freeze dried polyacid powder and glass powder are placed in a bottle. Liquid consists of water or water with tartaric acid, when they get mixed, the powder dissolves in acid to reconstitute the liquid acid followed by acid base reaction which are referred as water settable GIC.

Chemistry of setting

When powder and liquid are mixed, acid etches the surface of glass particles and ions are leached into the aqueous medium. Salt hydrates to form a glass matrix and unreacted glass particles are sheathed by silica gel, which arises from removal of cations from the surface of the particles.

Inspite of its advantages, GIC causes occurrence of tooth sensitivity after restoration and high early solubility. The tooth that to be restored should be dry but not excessively. The patient should not close on a cotton roll to help avoid saliva contamination of setting cement. Excessive dryness should also be avoided to prevent dehydration which can result in micro cracking with in the material. To prevent post cementation sensitivity it is mandatory to have a smeared layer and to maintain tooth from dehydration.

Resin modified glass ionomer cement

RMGIC came into existence in 1990s to overcome the two important undesirable properties of conventional GIC which are sensitivity to early moisture contamination and solubility [1].

Antonucci et al originally used the term resin modified Glass ionomer as the trival name and resin modified glass polyalkenoate as systemic name [2].These cements are also called as Hybrid glass ionomers[3]. It is available as Powder and liquid and Prepropotional encapsulated form or as a 2 paste system. Powder has a ion leachable glass and initiators for chemical/light curing, liquids contains BisGMA, HEMA, Polyacid, water. Other components include polymerization activators and stabilizers [4].

Chemistry of setting

When powder and liquid are mixed, two unique reactions occur. Resin phase polymerizes initially by chemical or light initiation and Glass ionomer phase matures slowly through acid-based reaction [5]. Generally, these cements can be chemical cured, light cured, dual cured or tricured.

Commercially available RMGIC are poly X luting, poly X luting plus (3m/ESPE), fuji plus (GC) and ultra cem RMGIC luting cement. RMGIC have superior physical and mechanical properties that of GIC, because of the possibility of hygroscopic expansion these cements are not recommended for luting metal and metal ceramic restorations [6].

HEMA is responsible for water sorption and hygroscopic expansion. Initial sorption may compensate for polymerization shrinkage, but continuous sorption leads to dimension change compared with Zinc Phosphate, GIC, Polycarboxylate. RMGIC has more compressive strength, diametral tensile strength and flexural strength, but is less than resin composites [7]. These are less sensitive to early moisture contamination with minimal postoperative sensitivity.

Compomer

These are Polyacid modified composites. These were introduced after RMGIC's in late 1990's.These are enhydrous resins that contain ion leachable glass as a part of filler and dehydrated polyalkenoid acid[8].

These have fluoride releasing capability of conventional GIC and durability of composites [9]. They have higher compressive strength and flexural strength than RMGIC but lesser than conventional composites. Fluoride release is lower than conventional GIC.

Compomers for luting purposes are available as a two-component system either P/L or as two pastes. Presence of water in these materials made them adhesive and an acid base reaction starts at the time of mixing. These materials are used primarily for cementing prosthesis with metallic substrates. Like RMGIC's and GIC's, compomers also absorb water and undergo hygroscopic expansion which may fracture all ceramic crowns.

Resin cements

Resin cements have become attractive as a luting agent because of the development of direct filling resins with improved properties. These are essentially flowable composites of low viscosity. It contains resin matrix with silane treated inorganic fillers that is silica or glass particles and/or colloidal silica. Based on the filler particle size it is of two types micro filler and hybrid composites. In vitro researches detected that compared to resin cements containing hybrid type filler, resin cement with micro fillers have greater resistance against wear[10]. Polymerisation can be achieved by a conventional chemical cure system or by light activation or dual cure system. Bonding of resin to enamel is by micromechanical interlocking of resin to hydroxyapatite crystals and acidic enamel prisms. Bonding to dentin is by penetration of hydrophilic monomers to partially demineralised apatite structure of etched dentin. Clinical and laboratory researchers found that resin cements are best for cementation of full ceramic restorations [11].

Resin cements lack fluoride release, to overcome this some resin cements have incorporated ytterbium trifluoride and fluorosilicate fillers to release fluoride, which is not upto the mark.

Resin cements can be used in a situation where optimal retention and resistance is needed. These are highly expensive with technique sensitive that can be used in cementation of full ceramic inlays, onlays, crowns, bridges and fiber reinforced bridges.

Resin adhesive cements

Adhesive nature of conventional bis-GMA resin cements can be improved by adding adhesive monomers which enables chemical bonding to tooth structure and to prepared metal surfaces [12]. Adhesive monomers include bis functional phosphate monomer, 10- methacrylayloxydecyl dihydrogen phosphate (MDP), Carboxylic monomer, 4-methacryloxyethyl tri metallic anhydride (4-META).

These resins have low affinity for precious metal alloys due to the lack of surface oxide coating and low chemical reactivity requiring need for some surface modifications to achieve chemical bonding [13].

Panavia was introduced in 1994, which was modified to include Hydroxyethylmethyl (HEMA) methycryloyl 5- amino salicylic acid and MDP which is intended to improve bond strength to dentin. Later panavia 21, it was marketed as a two-paste system and its polymerization requires exclusion of oxygen and a covering gel. Panavia F came into existence which is a two-paste system that is dual cured, self-etching and self-adhesive plus fluoride releasing agent[5]. C & B Metabond is a type of adhesive resin cement, where bis-GMA composite was modified by decreasing filler contents and adding 3% 2 hydroxy-3b-napthoxypropyl methacrylate in methyl methacrylate with 4-methacryloyloxyethyl trimelliate anhydride and tri butyl borane. It has extreme high tensile strength [14]. These materials are usually expensive and technique sensitive and they have no long shelf lives.

Hybrid acid based cal/glass ionomer

It is a new dental luting agent that is based on calcium aluminate and Glass ionomer that are intended for cementation of crowns and bridges, gold inlays and onlays, and all zirconia or all alumina crowns [15]. It is water based hybrid cement. Its PH gradually changes from the time to time and at the time of cementation it is acidic, after 3- 4 hrs it turns in to basic which made them bioactive. It has advantageous properties like apatite formation and remineralization with fluoride release.

Others

Luting agent for an implant supported restoration is based on those unique factors that a clinician uses to decide how much and how long restoration is needed for that particular restoration

Conclusion

The choice of an appropriate luting agent for final cementation of fixed crown and bridge units needs careful consideration as the ultimate success to a large extent depends on correct choice. Selection of luting agent to be used for a given restoration should be based on the basic knowledge of the materials available, the type of restoration to be placed, the requirements of the patient and experience of the clinician. With the advent of newer luting agents that are flooding in the market, the practitioners must be aware of the virtues and shortcomings of each cement type and select them appropriately.

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