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Retrospective Analysis of Most Preferred Luting Cement for all Ceramic Restorations

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ABSTRACT

Introduction: The high demand for esthetically pleasing restorations has resulted in the development and introduction of various dental ceramics. The dentist must choose not only the appropriate ceramic, on the basis of functional and esthetic demands, but also the cement and the cementation procedure for each system and clinical situation.

Materials and Methods: This study is a retrospective observational study conducted in a university hospital in Chennai. This study was carried out between the month of November 2020-March 2021. Data of patients who were given all ceramic restorations were included in the study sample. This was followed by Excel tabulation. Data was analysed using SPSS Software. The association of study variables was calculated using Chi Square test.

Results: Majority of the patients who were given all ceramic restorations were in the age group between 20-30 years. All ceramic inlays were widely used when compared to all ceramic onlays and all ceramic veneers (48.9%). Resin cement (62.6%)was most preferred when compared to GIC (37.4%).

Conclusion: The high demand for esthetically pleasing restorations has resulted in the development and introduction of various dental ceramics. The dentist must choose not only the appropriate ceramic, on the basis of functional and esthetic demands, but also the cement and the cementation procedure for each system and clinical situation. The clinician should give special consideration to the use of adhesives, resin cements and field isolation and adhere strictly to manufacturer's instructions.

Key words: All ceramic, improved aesthetics, luting agent, resin cement, GIC, innovative technology

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INTRODUCTION

Over the past decade the increasing demand for esthetically pleasing restorations has resulted in the development of all-ceramic systems for use in dental restorations (inlays, onlays, crowns, and implant-supported restorations). The absence of a metallic substructure in all-ceramic restorations allows them to have improved esthetics, since the underlying tooth structure can influence the final shade of the restoration and imitate the optical effects of the natural teeth which results in a more natural appearance [1]. These restorations are nonmetallic and biocompatible, which provide an advantage to soft tissue health since lesser amounts of plaque are recovered from ceramic surfaces [2]. It is quite acceptable in all-ceramic restorations to leave the margin of the prosthesis supragingival or equigingival, which adds the benefit of less traumatic impression making. Improved clinical performance, with the use of higher strength ceramics and adhesives for bonding the ceramic restoration to tooth structure, have led to an interest in all-ceramic restorations which make these restorations a favorable choice by patients and dentists [3].

“All ceramic” is a broad term for a class of materials that are fabricated and finalized with high heat to fuse the particles into a restoration. All-ceramic restoration materials can be divided into two distinct classifications: silicate ceramics and oxide ceramics [4].

Silicate ceramics refer to porcelains with a glass-rich silicate matrix that have a multiphase structure. The key to these ceramics is that they are made from silica-containing glasses, similar to the sand at a beach. This silica structure has additives to improve the physical properties of the ceramic material so it can function in the mouth. Silicate ceramics are of two types: feldspathic glass used as the porcelain on PFM crowns and bridges or applied to oxide ceramic (zirconia or alumina) cores. Feldspathic porcelains were used, and are still used, for porcelain veneers, but are not as popular as glass ceramics. Glass ceramics are the most popular today for all-ceramic crowns and veneers because of their esthetics and high strength [5].

Oxide ceramics are fabricated from metal oxides, zirconia, or alumina. They are characterized as monophase and single-component, with metal oxides comprising more than 90% of the structure. These ceramics have very high strengths but are generally more opaque in appearance and not as esthetic as the silicate ceramics [6].

The success and longevity of indirect restorations are influenced by the patient and operator. The patient manages oral hygiene, diet and functional habits while the operator manages tooth preparation, impression and cementation. Cementation is a crucial step in the process of ensuring the retention, marginal seal and durability of indirect restorations [7]. For cementation of all-ceramic crowns, bridges, inlays, and onlays, the most commonly used cements are glass ionomers (RMGIs) or composite resins. These cements can be self-curing or dual curing, where a light can be used to set the cement at the margin of the restoration [8].

Glass ionomer cements adhere to tooth structure by formation of ionic bonds at the tooth/cement interface as a result of chelation of the carboxyl groups in the acid with the calcium and/or phosphate ions in the apatite of enamel and dentin [9]. Resin-based composite cements usually consist of a bis-GMA/TEGDMA (2,2- bis[4-(2-hydroxy-3-methacryloyloxypropoxy) phenylpropane/ triethyleneglycol dimethacrylate) or polyurethane matrix in which micro-filler particles (0.04-0.2μm) of quartz are embedded. Heavy metals such as zinc, barium, strontium, or yttrium are incorporated into the glass to obtain radio-opacity. For a composite to have successful properties, a good bond should be formed between the inorganic filler and the organic matrix. This bond can be achieved by coating the filler particles with a coupling agent compound during manufacturing [9]. These resin composite cements are available [10,11] various shades and opacities, and their chemistry allows adherence to many dental substrates. Adhesion to enamel occurs primarily through surface irregularities created after acid etching (usually phosphoric acid). The etchant is used to remove the smear layer from tooth preparation, preferentially dissolving the hydroxyapatite crystals. Micromechanical retention will be obtained when the fluid adhesive subsequently penetrates the surface irregularities and becomes locked after polymerization. Resin composite cement can be polymerized through a chemically-initiated mechanism, photo-polymerization, or a combination of both. The aim of this study is to determine the most preferred luting agent for all ceramic restorations. Our team has extensive knowledge and research experience that has translate into high quality publications [12-31].

MATERIALS AND METHODS

Study design

This study was a retrospective observational study conducted in a university setting. Approval for the project was obtained from the Institutional Review Board of Saveetha Institute of Medical and Technical Sciences, Chennai, India.

Sampling

Data of patients were reviewed and then extracted. All patients who had undergone all ceramic restorations in the given duration of time period were evaluated. Only relevant data was included to minimize sampling bias. Simple random sampling method was carried out. Cross verification of data for error was done by presence of additional reviewer and by photographic evaluation. Incomplete data collection was excluded from the study.

Data Collection

A single calibrated examiner evaluated the digital case records of patients who reported to Saveetha Dental College from June 2020- March 2021 and were reviewed. Inclusion criteria consisted of patients who were given all ceramic restorations. Exclusion criteria consisted of patients who were given other indirect restorations.

Statistical analysis

The collected data was tabulated and analyzed with a statistical package for social sciences for windows, version 20.0 (SPSS Inc., Vancouver style) and results were obtained. Categorical variables were expressed in frequency and percentage. Chi square test was used to test association between categorical variables. Chi square tests were carried out using age, gender and as independent variables and dependent variables. The statistical analysis was done by Pearson chi square test. P value < 0.005 was considered statistically significant.

RESULTS

Based on the age of the patient, the age group evaluated for a maximum number of cases included 20-30 years, accounting for 38.9% of overall cases, 31-40 years accounted for 36.6% of overall cases, 41-50 years accounted for 16.8% of overall cases. 51-60 years accounted for 4.6% of cases and 61-70 years age group accounted for 3.1% overall cases (Figure 1).

Based on the gender of the patient, males accounted for 61.1% cases, and females accounted for 38.9% cases (Figure 2).

Based on the treatment inlay was accounted for 44.3% of overall cases, veneers accounted for 37.4% of overall cases, onlay accounted for 18.3% of overall cases (Figure 3).

Based on the luting agent resin cement 59.5% was preferred over GIC 40.5% (Figure 4).

Based on the association between treatment and luting agent, resin cement was used in maximum number of

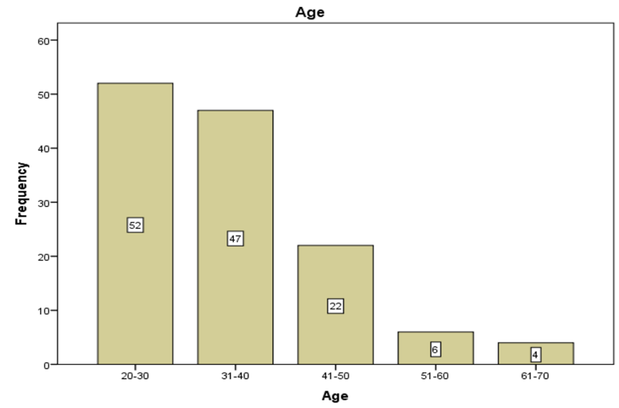

Figure 1: Bar graph shows the distribution of age among patients who were given all ceramic restorations. X axis denotes age whereas Y axis denotes the number of patients. Majority of the patients who were given all ceramic restorations were in the age group between 20-30 years (38.9%).

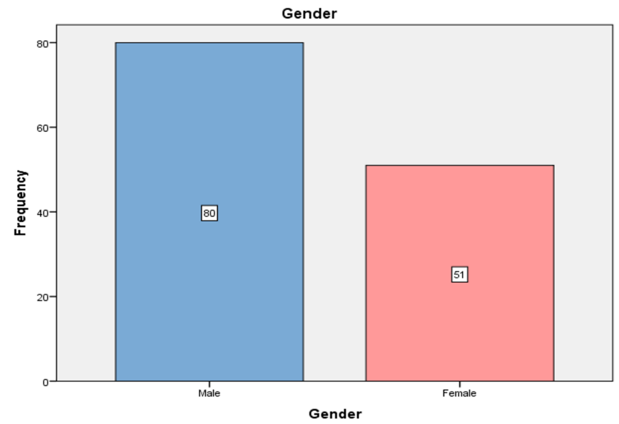

Figure 2: Bar graph shows the distribution of gender among patients who were given all ceramic restorations. X axis denotes gender whereas Y axis denotes the number of patients who were given all ceramic restorations. Majority of the patients who were given all ceramic restorations were males (61.1%) compared to females (38.9%).

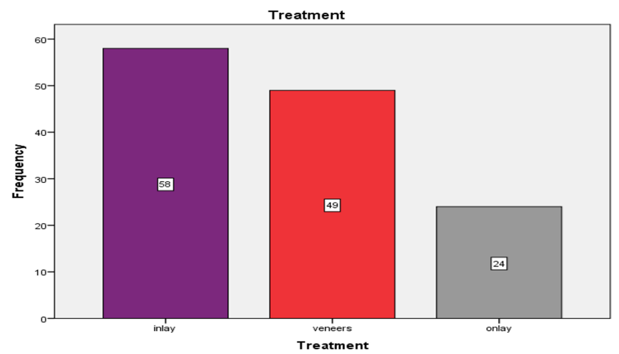

Figure 3: Bar graph shows the distribution of different types of treatments done with all ceramic restorations. X axis denotes the type of treatment. Y axis denotes the number of patients. The most common all-ceramic restoration given was inlay (48.9%).

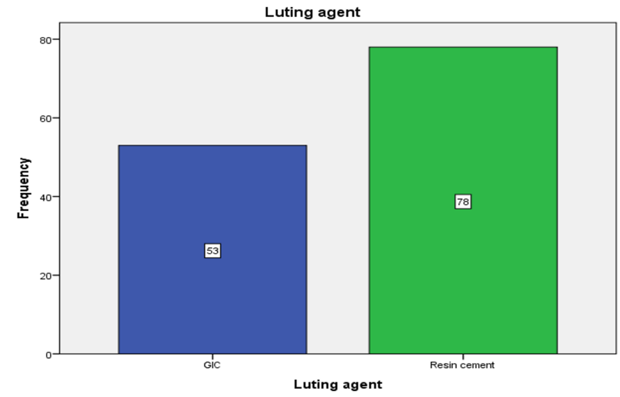

Figure 4: Bar graph shows the distribution of luting agents used for all ceramic restorations. X axis denotes the luting agent. Y axis denotes percentage of patients. Resin cement (62.6%) was most preferred when compared to GIC (37.4%).

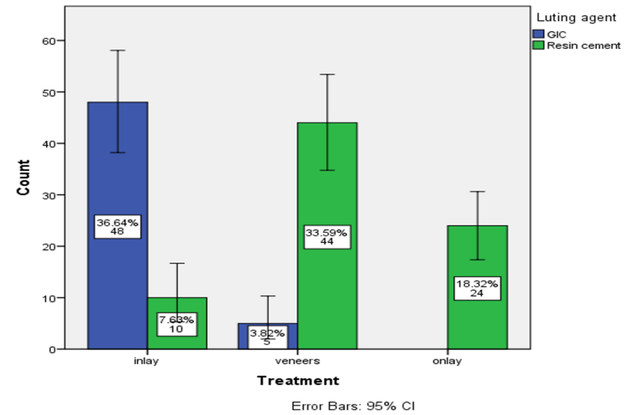

Figure 5: Bar graph shows the association between treatment and luting agent. X axis denotes treatment and Y axis denotes luting agent. Majority of the treatment used resin cement (blue) as the luting agent when compared to GIC (green). (Chi Square value=1.120; p value=0.476(>0.05), statistically not significant.

cases (Figure 5).

DISCUSSION

In this study it is observed that the age group between 20-30 years were given all ceramic restorations when compared to other age groups. This finding is in consensus with previous studies. All-ceramic crowns offer potentially excellent aesthetics and they are often more conservative than PFM crowns as there is no need to prepare a margin that accommodates both porcelain and metal. As all-ceramic crowns are metal-free, it has been claimed there are no problems associated with corrosion and biocompatibility or interferences in translucency More recently, advances in dentin bonding have resulted in the so-called dentine-bonded all-ceramic crown. Advantages of these crowns include excellent aesthetics, conservative tooth preparation and resistance to fracture [32].

In this study the most preferred luting agent was found to be resin cements when compared to GIC. Resin cements by virtue of their chemical structure are more resistant to dissolution by water, beverages, saliva and gingival crevicular fluid and offers better resistance to plaque accumulation and microbial colonization; whereas, GIC prone to dissolution and subsequent secondary caries of the abutment could occur with time [33]. Resin cements have been modified to release fluoride to prevent secondary caries. Contemporary adhesive cements provide for excellent marginal integrity to compensate for any discrepancies between the restorative material and tooth preparation [34,35]. Resin composite cements exhibit high compressive strength, resistance to tensile fatigue, and are virtually insoluble in the oral environment They have the ability to bond chemically to resin composite restorative materials and to silanate porcelain. Their ability to adhere to multiple substrates, high strength, insolubility in the oral environment, and shade-matching potential have made resin composite cements the adhesive of choice for esthetic type restorations, including resin composite inlays and onlays, all-ceramic inlays and onlays, veneers, crowns, FPDs, and the newly developed fiber-reinforced composite restoration [36].

The commonly used resin cements are Bis-GMA, urethane dimethycrylate and PMMA based cements. However Petropoulou et al 2015 stated the disadvantages associated with resin cements which includes soft tissue irritation, periodontal breakdown when the cement is not cleaned properly following luting. Since the resin cements are highly resistant to dissolution the cement that remains trapped inter-proximally can induce a marked inflammatory response triggering periodontal breakdown [37].

CONCLUSION

With the increase in the number of contemporary cements used for indirect restorations, clinicians are faced with an important choice when deciding which cement to use for each clinical situation. Although no one cement fulfills all the needs for all cementation, understanding the differences between each class of dental cement will contribute to clinical success of the restoration.

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CONFLICT OF INTEREST

None

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