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Assessment of Class Ii Ceramic Inlays Done in Mandibular Molars- A Retrospective Analysis

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ABSTRACT
In recent years, aesthetics in dentistry has become increasingly more important to patients, since aesthetics play a huge role in increasing the confidence levels of people. The main goal of a dentist is to be aware of advantages and disadvantages of different restorative systems with aesthetic appearance available for the restoration of posterior teeth. The aesthetically pleasing restorative treatment options available are resin composites,which can be added directly into the cavity and has limited applications and Ceramic inlays, which require thorough processing and has wider applications.Ceramic inlays may provide a high level of wear resistance and aesthetics and is favoured among dentists and patients alike.The main aim of this study is to assess the number of Class II Ceramic inlays done.About 30 case sheets of patients who underwent class II ceramics restoration between June 2019 - April 2020 from a Private Dental College in Chennai. The collected data were analysed using SPSS statistics and Barcharts were plotted for the collected data. Results showed that there was equal gender distribution among the study group(50% males and 50% females) and that the common site for class II ceramic inlays among lower molars was mandibular first molar (64.29%). Within the limits of this study, class II ceramic inlays were found to be more prevalent and the most commonly involved teeth were mandibular first molars.

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INTRODUCTION

Dental caries and consequently, significant loss of tooth structure due to trauma [1],[2] is a common clinical complaint among patients visiting dental clinics. Usually, Full crowns are used for restoration of the function and aesthetics of the affected tooth and for protection from mechanical, chemical and/or microbial injury [3] to the teeth caused by caries or other causes including extrinsic sources such as consumption of beverages with high acid content, occupational acid exposure and workers from battery industries and intrinsic sources such as reflux of gastric acid into the oral cavity [4],[5],[6],[7],[8]. But, crowns also posed a disadvantage of development of secondary caries beneath the restoration and fracture of restored teeth. [9]. With increasing demands for aesthetics among patients and need for efficient restoration of the affected tooth, many alternative methods were

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devised ,among which ceramic inlays were found to be of interest among dentists and patients alike [10],[11],[12],[13],[14],[15],[16],[17]

Aesthetically pleasing restorations in posterior teeth form an integral part of modern dentistry. Different types of materials to enhance aesthetics in dentistry were introduced into dentistry, such as direct resin composites, inlays,onlays and crowns. The ceramic inlays were regarded at higher levels due to its aesthetic appearance and marginal accuracy, i.e., ability to bend to the teeth [18] ,[19]. Other factors which leads to favouring of ceramic inlays include tooth preparation required for fabrication of inlays. They are extensively used in dentistry, since ceramic inlays were found to be biocompatible, strong, durable, stain resistant, show longevity, little recovery time, good clinical performance and are minimally invasive compared to crowns [20]. During the past decade, ceramic inlay restoration has expanded due to enhanced development in dental adhesives and resin cements, which aids in increasing the fracture resistance of dental ceramics [21]. Many studies have shown that ceramic inlays have excellent stress bearing properties and good aesthetics. Some studies have also shown that success rates of ceramic inlays were very high [22],[23],[24]. There are different types of ceramic which are IPS E.MAX material,IPS Empress II system which were unique in physical properties and flexural strength[25].

Previously we have focused our research on various invitro and invivo studies. [26–45] We have currently shifted our focus to this retrospective analysis. The main aim of this study is to assess the number of class II ceramic inlays procedures done.

MATERIALS AND METHODS

The study was set in university setting and Institutional Ethics Committee approval was obtained (ethical approval number - SDC/SIHEC/2020/DIASDATA/0619-0320)for retrieval of about 954 case sheets of patients who were diagnosed with class II caries were obtained from Saveetha Dental college , among which, 30 casesheets of patients, who underwent class II ceramic inlay restoration procedure mesio-occlusally and disto -occlusally between June 2019-March 2020 were segregated. The upside of this study was reasonable data and its downside was geographic limitation and limited availability of data. The data obtained were analysed and are divided into 2 groups - class II ceramic inlays MO and class II ceramic inlays DO.The variables recorded were age ,gender,ceramic class II MO/DO. The internal validity was done by creation of a study design and complete collection of data and external validity is done by setting study design in hospital and departmental setup followed by setting up of self diagnostic criteria and is replicated. These data were cross verified by 2 reviewers and incomplete data and irrelevant data were removed.

Data collection was done by entering data into Microsoft Excel and then transferred into Statistical Package for Social Sciences (SPSS) software.The independent variables present in the study were age,sex and the dependent variables were Class II ceramics.The type of analysis used for this study was chi square test. The steps for data analysis are as follows : data tabulation was done by entry of data into excel sheet, followed by plotting of bar graphs for the same data.

RESULTS AND DISCUSSION

The data obtained were analyzed and plotted in the form of a bar chart using SPSS statistics software. The age distribution among the study population showed that there were equal gender distribution (males-50%,females-50%)(Graph-I).The most common region of class II ceramic inlay restoration was disto occulusal (DO) (64.3%)(graph-II) and the common site of class II ceramic inlay restoration among mandibular molars were mandibular 1st molars (64.3%) (graph-III).

Dental caries is the most common cause of enamel loss in a clinical situation. They are easily detectable and reversible at an early stage. Once the incipient lesion proceeds to cavitation, the condition becomes irreversible [46],[47]. Hence it is necessary to prevent the progression of dental caries[48] at an early stage, rather than to develop treatment strategies for progressive dental caries [49],[50]. Enamel is subjected to innumerable cycles of demineralization and remineralization throughout its lifetime, which controls the progression or reversal of caries.With recent advances in dentistry,many options were introduced for treatment of caries, which include composite resin restorations, inlays,onlays etc., In direct composite resin restorations, the most important drawbacks were affinity to fracture, wearing of the marginal seal which leads to pulpal irritation, postoperative sensitivity, marginal staining, and secondary caries., Other disadvantages of composite resins include insufficient interproximal and occlusal morphology due to its difficult clinical handling procedures. The ceramic inlay and onlay restoration has been used to reduce the polymerization shrinkage and can be adapted according to the design of the prepared cavity[51]. Ceramic inlays have become a popular choice among patients and dentists alike and are are preferred over other alternatives for its aesthetic properties and is less harmful to periodontal health[52] when compared to other options like porcelain crowns. Similar findings were observed in studies by Pihlaja J et al.,[9] and Behr M et al.,[53],where it was observed that use of porcelain crowns caused more complications to

periodontal health when compared to the use of ceramic inlays.
Many studies have shown that ceramic inlays are more viable [22].and has a high success rate in restoration of posterior teeth by Beier US et al.,[23].Previous studies by Schaefer O et.al.,[24] and Fasbinder DJ et. al.,[54] also confirmed this finding.Ceramic inlays are also preferred due to its excellent survival rates[21]. Findings of previous study by Schulte AG et.al.,[55],confirmed this fact. Findings of Frankenberger R et.al., also confirmed this finding.However ,this was contradictory to the findings of Hayashi M et.al.,[56],Gordon J [57],where it was shown that ceramic inlays have low survival rates.This can be attributed to the fact that ceramic inlay can be subject to fracture due to lack of availability of thickness , improper cavity design ,defects such as pores and cracks in ceramics[58] .However, despite its minor disadvantages , class II ceramic inlays are preferred the most among patients and dentists alike for restoration of endodontically treated tooth/tooth affected by dental caries.Several studies showed that ceramic inlays presented satisfactory results. Similar results were seen in previous studies by Friedl et al [59]., and Thonemann et al [60]., where the clinical performance of ceramic inlays and onlays were evaluated.
Preparation design is based on the properties and nature of the selected restorative material, fabrication method and the ability to bond the restoration to the tooth. Retention forms of cavities are not considered to be crucial due to the nature of bonding of the restoration and hence, bevelling is contraindicated. 90° is the preferred cavosurface angle, and the smooth-flowing margins are required for facilitating the fabrication of the restoration. Rounded internal line angles and the butt-joint cavosurface margins facilitate many aspects of conventional laboratory or chair-side inlay fabrication.It is very important to avoid undercuts in the cavity preparation. A minimum convergence of 10°–12° in cervico-occlusal axial wall is required for cast-inlay preparations. Box walls with divergence occlusally, approximately by 10° or more, will facilitate optical capture and reduces the risk of excessive binding during seating for initial evaluation[58]. Towards the pulp, it is necessary to do axial reduction in proximal boxes and it should be a minimum of 1–1.5 mm depth. This is necessary for conservation of tooth structure and the reduced need for bulk of ceramic. Usually, base material is recommended , based on the amount of remaining residual tooth structure, post caries removal.
Recording of elastomeric impression of the prepared tooth and the adjacent teeth and interocclusal records for the same, is an essential for inlay procedure. The impression obtained, helps in fabrication of a working cast, which can be used for inlay fabrication. No working cas is required if procedure is done chairside. In this study, elastomeric impression was used to obtain the impression of tooth after cavity preparation.
Ceramic inlays can be fabricated either indirectly in the dental laboratory or directly in the dental office using chair-side CAD/CAM systems. Several methods for laboratory fabrication include firing of porcelain on a refractory die system, usage of pressed glass ceramic with lost-wax technique, castable ceramics, or milling from prefabricated ceramic blocks.[61]. Rounded internal line angles are advised for both pressed and milled ceramic inlays. In the case of pressed ceramic inlays , the rounded internal form allows reduced risk of binding and potential fracture of the inlay on seating.
Commonly available luting agents, which are used for luting of inlay systems are zinc phosphate cements, glass ionomer cements, hybrid ionomer cements, resin modified glass ionomer cements, polyacid modified resin cements, and resin cement [62]. Zinc phosphate cement was the first luting agent introduced into dentistry and has been in use since 130 years. Resin-modified glass ionomer luting agents (RM-GIC) were also considered, since they are known for better strength, in comparison to the strength of traditional glass ionomer cement, and their potential fluoride release. Resin luting agents are known to have higher bond strength when compared to that of traditional glass-ionomer cement. The dual-cured cement for luting of ceramic inlays were preferred, because of their varying ceramic thickness, which requires light to pass through the cement for activation of the polymerization reaction. These resin luting agents require exposure to visible light to prevent incidence of discolouration, and with longer exposure time. Ceramic inlays are superior to composite resin inlays when it comes to light transmission, and hence dual cure resin luting cements are considered to be a good choice for luting of ceramic inlays[63].

LIMITATIONS
Reduced sample size, unequal distribution of cases and geographic limitations were the limitations posed to this study.

FUTURE SCOPE
Large sample size and expansion of geographic area can yield better,accurate results for this study.

CONCLUSION
Within the limitations of this present study it can be concluded that, class II ceramic inlays were found to

be more prevalent and the most commonly involved teeth were mandibular first molars.

With the recent advancements in fabrication and luting techniques for ceramic inlays, ceramic inlays could be a better treatment option for restoration of class II caries.

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AUTHOR CONTRIBUTIONS

All authors have equal contribution in bringing out this research work.

CONFLICT OF INTEREST

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ETHICAL CLEARANCE

It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number-SDC/SIHEC/2020/DIASDATA/0619-0320)

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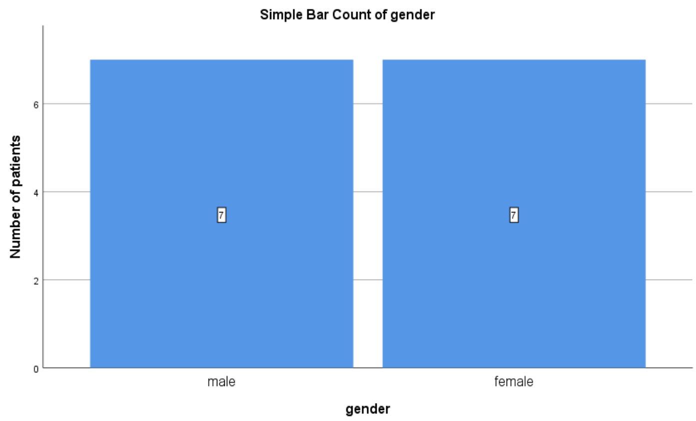

Figure 1: This is a bar graph representing the distribution of gender among study population. The X axis represents the gender and Y axis represents the total number of patients. A total of 14 patients, 7 patients were male, 7 patients were female, showing there was equal gender distribution among the study group.

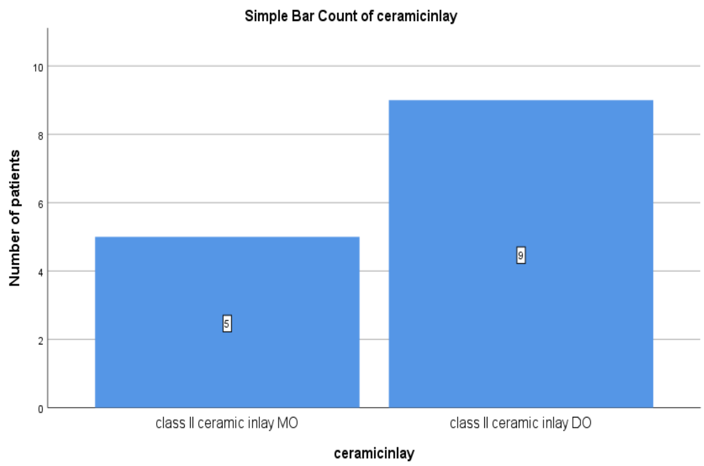

Figure 2: This is a bar graph representing the distribution of the class II ceramic inlays among study population. The X axis represents the number of class II ceramic inlays and Y axis represents the total number of patients. Class II ceramic inlays DO were more commonly done.

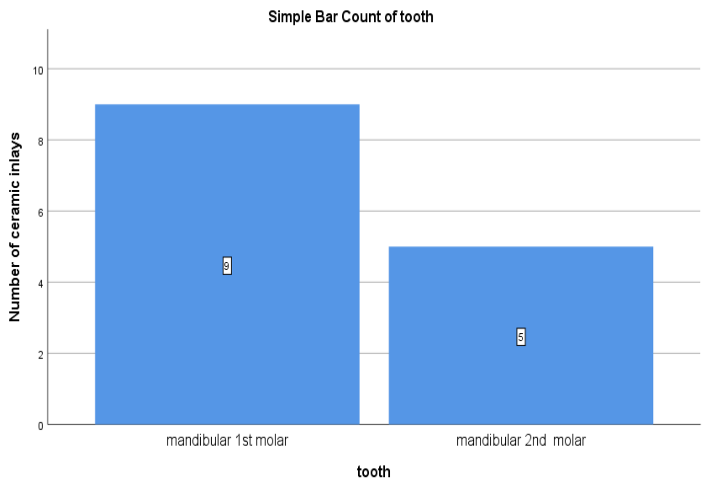

Figure 3: This is a bar graph representing the distribution of mandibular molar teeth with the total number of patients. The X axis represents the mandibular molars and Y axis represents the total number of patients. Class II ceramic inlays were more commonly done in mandibular 1st molars.

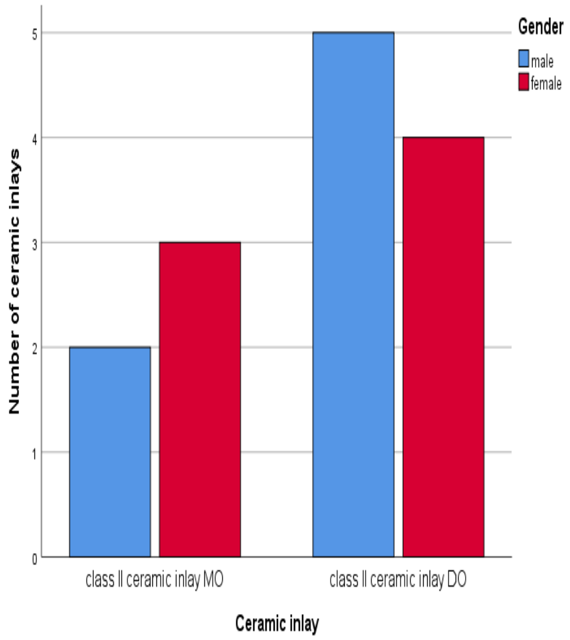

Figure 4: This is a bar graph representing the association between gender and class II MO and DO. The X axis represents the MO/DO Class II ceramic inlays among gender distribution and Y axis represents the total number of class II ceramic inlays. From this graph, we infer that Class II ceramic inlays MO were done more commonly in females (red) and class II ceramic inlays DO were done more commonly in males (blue). Chi square test; p-value: 0.57, which is statistically not significant.

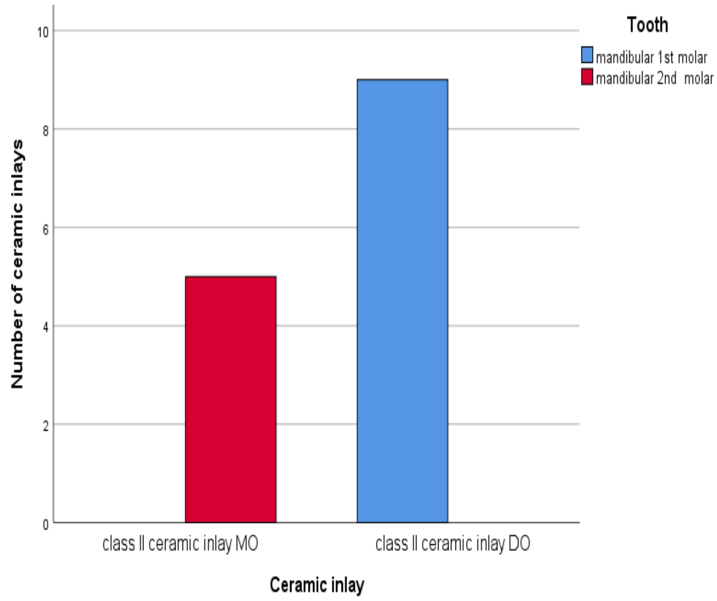

Figure 5: This is a bar graph representing the association between the tooth number and class II ceramic inlays MO/DO. The X axis represents the MO/DO Class II ceramic inlays among tooth number distribution and Y axis represents the total number of Class II ceramic inlays. From this graph, we infer that class II ceramic inlays were more commonly done in mandibular second molars (red) and class II ceramic inlays DO were more commonly done in mandibular first molars (blue). Chi square test; p-value: 0, which is statistically significant.