

MARGINAL ADAPTATION OF CLASS II CERAMIC RESTORATIONS - A RETROSPECTIVE ANALYSIS

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ABSTRACT

Background: Dental porcelain (also known as dental ceramic) is a dental material used by dental technicians to create biocompatible lifelike dental restorations, such as crowns, bridges, and veneers. Evidence suggests they are an effective material as they are biocompatible, aesthetic, and insoluble and have a hardness of 7 on the Mohs scale. For certain dental prostheses, such as three-unit molars porcelain fused to metal or in complete porcelain group, zirconia-based restorations are recommended. The word "ceramic" is derived from the Greek word κέραμος *keramos*, meaning "potter's clay". It came from the ancient art of fabricating pottery where mostly clay was fired to form a hard, brittle object; a more modern definition is a material that contains metallic and non-metallic elements (usually oxygen).

Aim: - The aim of study was to assess the marginal adaptation of various class II ceramic restorations.

Materials and Methods: - The study involved all the patients who attended the University for Class 2 Restorations, for whom ceramic restorations were given.

Results: - The maximum number of treatment done was for the male population and it was class II ceramic inlay DO and the least number of treatment done was class II ceramic inlay MOD for the male patients. Maximum number of class II restorations were done in 36 (lower left molar). For class II ceramic inlay DO grade A was given for 23.53% of the total procedures but for class II ceramic inlay MO for 23.53% were given a B grade and 16.18% only were provided with A grade. That indicates that class II ceramic inlay DO were done more with more perfection than others which in turn indicates that class II ceramic inlay DO have better marginal integrity and shade matching when compared to the other restorations done.

Conclusion: Hand skills of a clinician definitely decides the longevity and durability and the properties of any treatment that is delivered to a patient, through our study we have assessed marginal adaptation of class II ceramic restorations found to be very good.

Keyword: All ceramics, Ceramic Restoration, Class II restorations, Marginal adaptation.

INTRODUCTION

Presently, patients are more demanding for esthetic restorations in posterior teeth. While amalgam has long been the standard restorative material for most patients, the initial color or the result of all the changes occurring in the corrosion process cause the patient to demand something more esthetic. Posterior composite resins are used by numerous dentists to rectify this problem. However, the posterior composite resin is extremely technique sensitive and furthermore, it is far less stable than the ceramic restorative material. In addition to the inadequacies in terms of marginal adaptation, the direct filled posterior composite resin commonly exhibits problems related to proximal contour and contact. The results are characterized by rather high incidences of postoperative sensitivity. In this regard then, the ceramic inlay/onlay restorative material is considered by many to be a superior alternative. Aesthetic restorations in the posterior region must tolerate masticatory stresses and maintain an adequate amount of anatomic configuration at the occlusal and interproximal regions.

Longevity of posterior restorations is limited by many factors - especially the materials, the patient and the dentist (Hickel and Manhart 2001; Manhart et al. 2000; Manhart and Hickel 1999). Hypersensitivity, staining, secondary caries by bacterial penetration under cyclic loading and cusp displacement, with possible crack and dental fracture development at surroundings walls, are documented clinical and microscopic consequences. Shrinkage phenomena are influenced by the material composition – especially volume percent of inorganic filler, irradiation modes, quality of polymerization, degree of conversion and boundary conditions, [(Sarcev, Petronijevic, and Atanackovic 2012; Takahashi et al. 2010)]. Bulk fill composites may partially overcome some of these limits as an alternative to a careful layering technique (Fabianelli et al. 2010). Light irradiation modes require careful consideration. Also material combinations using a base layer of 0.5 - 1 mm on the cavity floor may improve the marginal integrity of adhesive restoration (Wattanawongpitak et al. 2006; Takako Yoshikawa et al. 2014; T. Yoshikawa, Burrow, and Tagami 2001). In these cases materials with lower rigidity and minimal or zero shrinkage are indicated. Even though in the literature there are some studies reporting combinations of materials in the form of multilayer systems, the current research was focused on a further analysis on ceramic in class II dental restorations. Our team has extensive knowledge and research experience that has translate into high quality publications(Muthukrishnan 2021a; PradeepKumar et al. 2021; Chakraborty et al. 2021; Muthukrishnan 2021b; Teja and Ramesh 2020; Narendran et al. 2020; Reddy et al. 2020; Sawant et al. 2021; Bhavikatti et al. 2021; Karobari et al. 2021),(Rohit Singh and Ezhilarasan 2020; Ezhilarasan 2020; Romera et al. 2018; Raj R, D, and S 2020),(Vijayashree Priyadharsini 2019; Priyadharsini et al. 2018; Uma Maheswari, Nivedhitha, and Ramani 2020; Gudipaneni et al. 2020; Chaturvedula et al. 2021)(Kanniah et al. 2020)

MATERIALS AND METHODS

The study was conducted in a university setting, by reviewing data of patients who visited college for class II restorations and two reviewers were included in the study. The advantages of the study was the data belongs to the people of similar ethnicity and the limitations of the study was the trends in other locations were not assessed. The study included all the patients with class II dental caries who have registered for ceramic restoration in the university, the patients who underwent class II restorations using composite and amalgam were excluded from the study. A total of sixty eight entries were finalized. The data was tabulated by using Microsoft Excel software and exported to SPSS for statistical analysis. The statistical analysis was conducted by Chi- square test.

RESULTS

Maximum number of class II ceramic DO were done in 46 (lower right molar)- 14.71% and the maximum number of class II MO restorations were done in (upper left first molar)- 1.47%. The colour of the bar indicates, blue- class II ceramic inlay DO, green-class II ceramic inlay MO, beige-class II ceramic inlay MOD. The p value was found to be 0.00 and the association was found to be significant, more class II ceramic restorations done in molars compared to premolars (Figure 1). Maximum number of treatment done was class II ceramic inlay DO for the male population that is 36.76% and the least number of treatment done were class II ceramic inlay MOD for male patients and its 1.47%. The colour of the bar indicates, blue- class II ceramic inlay DO, green-class II ceramic inlay MO, beige-class II ceramic inlay MOD. The P value was found to be 0.019 which makes the association statistically significant, thus male patients had more class II ceramic restorations compared to female (Figure 2). Over all 91.18 had better marginal adaptation in class II ceramic Inlay restorations of which in class 2 Ceramic inlay (DO) 39.71% resulted in better marginal adaptation, In class 2 Ceramic inlay (DO) 45.59% resulted in better marginal adaptation and in class 2 Ceramic inlay (MOD) 5.88 resulted in better marginal adaptation. The p value was found to be 0.8 which made the association statistically not significant as many of the restorations had very good and good marginal adaptation (Figure 3).

DISCUSSION

Many patients prefer tooth-colored, all ceramic restorations for reasons of esthetics and biocompatibility. With the introduction of improved dentin adhesive systems, (M. Miyazaki et al. 1998)(Finger and Fritz 1996) bonded ceramic restorations are recognized as an alternative to direct restorations and onlays. Adhesively luted restorations offer the ability to stabilize hard tissues, making preservation of the residual coronal tooth structure of severely destroyed teeth possible. Bonded restorations are alternatives to conventional crowns, which require macro mechanically styled, destructive preparations. Indirect all-ceramic restorations (ACRs) were introduced independently by Horn, Simonsen, and Calamia in the early 1980s (Spear and Holloway 2008). They appealed to patients who desired a metal-free restoration (Fasbinder 2006). The ACR represented a significant esthetic improvement over all-metal and metal-ceramic restorations (Zhang and Kelly 2017). Ceramic materials with high aluminosilicate

glass, such as feldspathic porcelain, contain fillers such as leucite, nepheline, or albite are added to improve their physical properties.

The maximum number of class II restorations were done in 36 (lower left molar) (Figure 1), maximum number of treatment done was for the male population and it was class II ceramic inlay DO and the least number of treatment done was class II ceramic inlay MOD for the male patients (Figure 2). Over all 91.18 had better marginal adaptation in class II ceramic Inlay restorations of which in class 2 Ceramic inlay (DO) 39.71% resulted in better marginal adaptation, In class 2 Ceramic inlay (DO) 45.59% resulted in better marginal adaptation and in class 2 Ceramic inlay (MOD) 5.88 resulted in better marginal adaptation. The p value was found to be 0.8 which made the association statistically not significant as many of the restorations had very good and good marginal adaptation (Figure 3).

ACRs appear very similar to natural teeth. However, due to the irregular microstructure of the glass matrix infused with fillers, they do not possess fracture resistance comparable to natural teeth. This limited ACRs composed primarily of glass to anterior areas (Kelly and Benetti 2011).

To improve the physical properties of the ACR, filler particles such as lithium disilicate, alumina, and spine were added to the glass matrix. This gives greater strength to the restoration. With a high filler content and lower glass content, these ceramics have greater fracture resistance. The development of Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) of ceramic restorations have the increased ability of dentists to deliver high quality

ACRs (T. Miyazaki et al. 2009; Tamaki et al. 2010). CAD/CAM ceramic restorations can often be made in one appointment. This eliminates the need to fabricate a physical master impression, stone casts, and provisional restoration (Bindl, Lüthy, and Mörmann 2006). By using the CAD/CAM system, the dentist is able to keep the milling process in-office, thus bypassing the need for the dental laboratory (Beuer, Schweiger, and Edelhoff 2008). The milling process is faster, and most importantly, CAD/CAM restorations have become more accurate in terms of anatomic appearance, and interproximal and occlusal contacts (Rocca et al. 2010). Research has shown that the long term acceptability and marginal integrity of single crowns fabricated by CAD/CAM technology are similar to single crowns fabricated by traditional laboratory methods over a 3 year time period (Wittneben et al. 2009).

The ACR has benefited from advances in resin bonding (Hopp and Land 2013). A considerable advantage of the ACR is the dentist is able to adjust the shade of the final result by using resin cements (Hanson 2015). There is an increasing range of shades in resin cements that can be used to modify the shade and value of the restoration. The resin cement can also block out any potential imperfections present in the prepared tooth from being externally visible (Niu, Agustin, and Duane Douglas 2014).

CONCLUSION

The more the clinicians hand works the better the life of the restorations will become as well as it will improve the quality of the patient's life. As medical professionals we are bound to

provide the best for the patients and it comes with making our work more perfect. From our study we can conclude that the maximum restorations that are done more perfectly are class II ceramic inlay restorations.

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AUTHOR CONTRIBUTION

Author 1(Chithralekha B), carried out the study by conducting the survey and drafted the manuscript after performing the necessary statistical analysis. Author 2(Dr.Pradeep S) aided in conception of the topic, has participated in the study design, statistical analysis and has supervised the preparation of the manuscript. All the authors have discussed the results among themselves and contributed to the final manuscript.

CONFLICTS OF INTEREST

All the authors declare that there was no conflict of interest in the present study.

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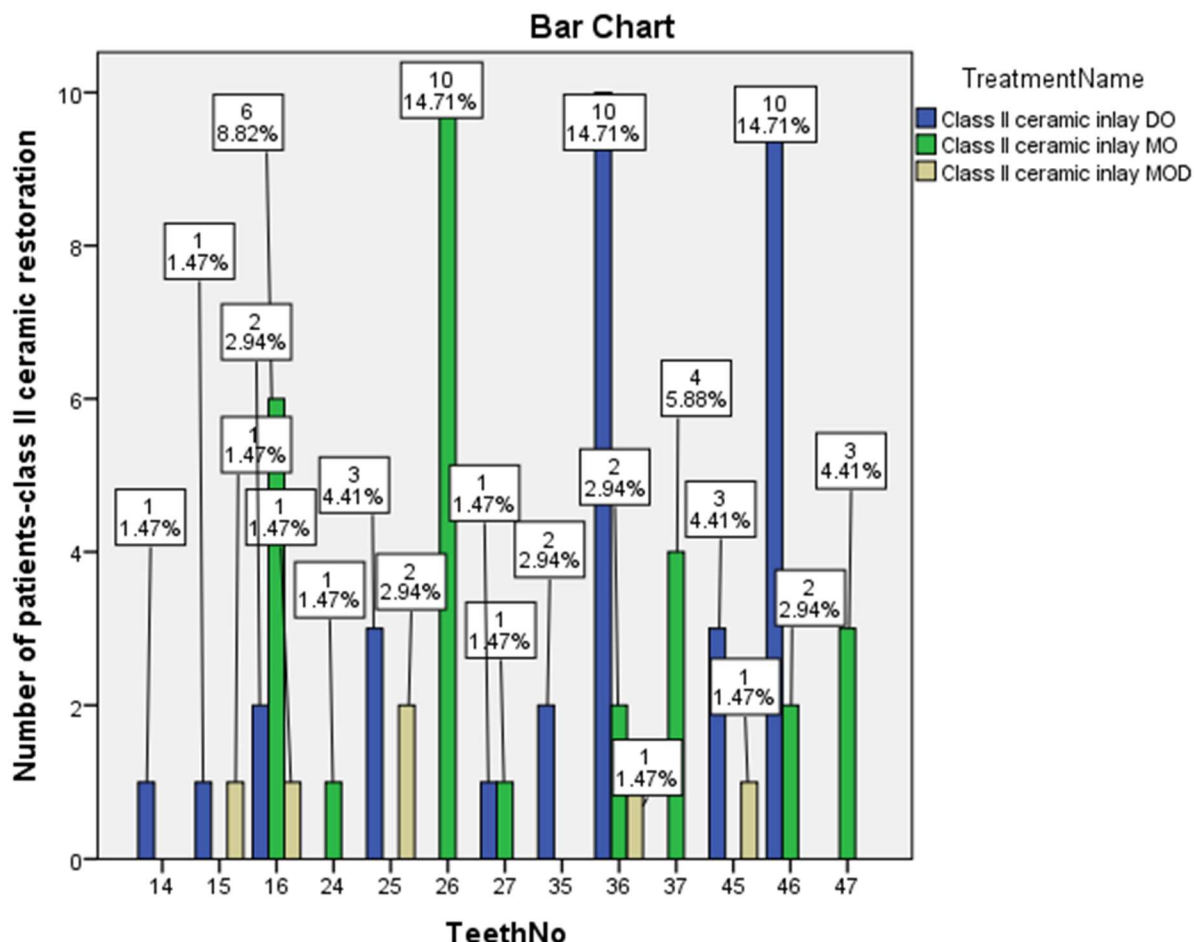


FIGURE 1:- The bar graph depicts the association of class II restoration according to the teeth number. X axis represents the teeth number and Y axis represents the number of patients who received class II ceramic restorations. Maximum number of class II ceramic DO were done in 46 (lower right molar)- 14.71% and the maximum number of class II MO restorations were done in (upper left first molar)- 1.47%.The colour of the bar indicates, blue- class II ceramic inlay DO, green-class II ceramic inlay MO, beige-class II ceramic inlay MOD. The p value was found to be 0.00 and the association was found to be significant, more class II ceramic restorations done in molars compared to premolars.

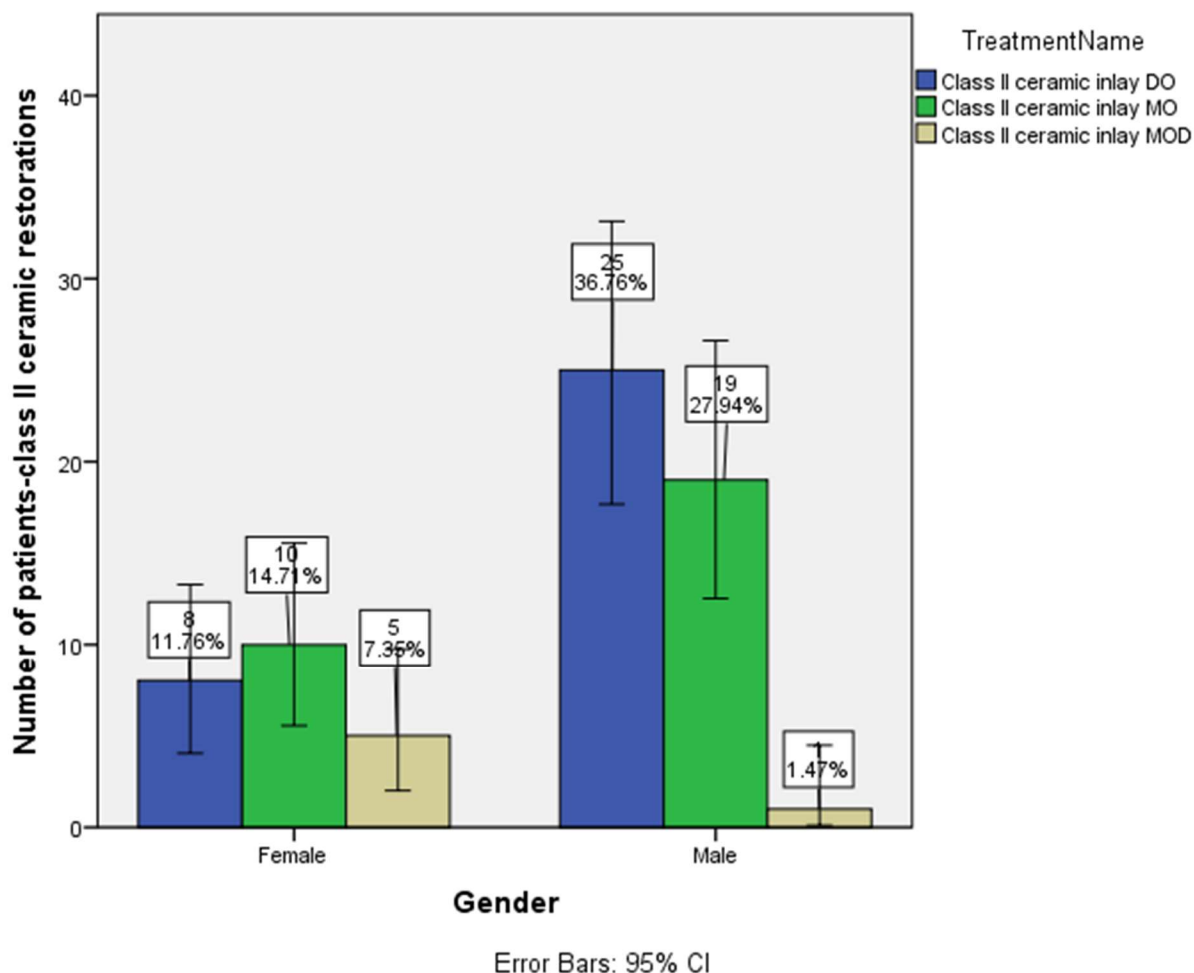


FIGURE 2 depicts the bar diagram with X axis representing the gender and Y axis representing the number of patients who have received class II ceramic restoration. Maximum number of treatment done was class II ceramic inlay DO for the male population that is 36.76% and the least number of treatment done were class II ceramic inlay MOD for male patients and its 1.47%. The colour of the bar indicates, blue- class II ceramic inlay DO, green-class II ceramic inlay MO, beige-class II ceramic inlay MOD. The P value was found to be 0.019 which makes the association statistically significant, thus male patient had more class II ceramic restorations compared to female.

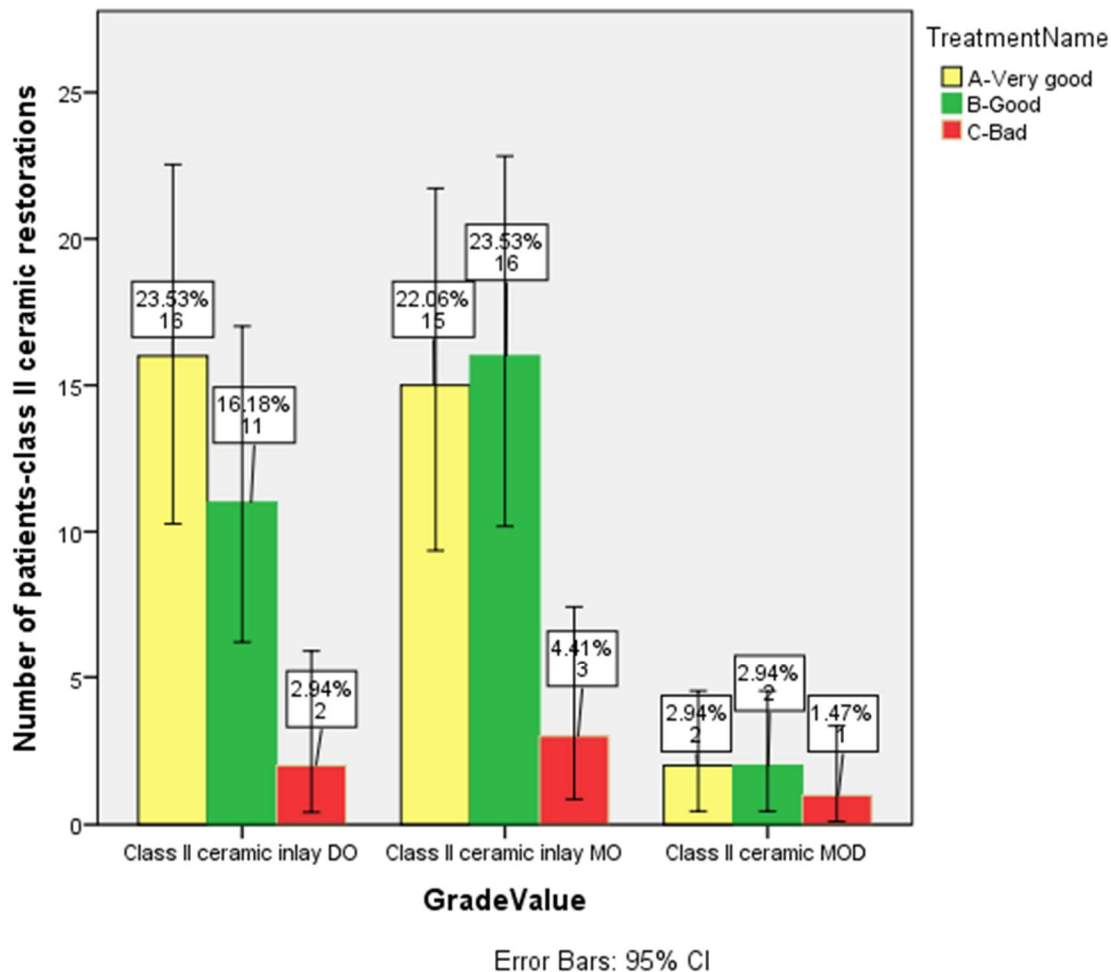


FIGURE 3 depicts the association of grade value and the number of patients who have undergone class II restoration. X axis represents the grade value and Y axis represents the number of patients who have undergone Class II ceramic restoration. Over all 91.18 had better marginal adaptation in class II ceramic Inlay restorations of which in class 2 Ceramic inlay (DO) 39.71% resulted in better marginal adaptation, In class 2 Ceramic inlay (DO) 45.59% resulted in better marginal adaptation and in class 2 Ceramic inlay (MOD) 5.88 resulted in better marginal adaptation. The p value was found to be 0.8 which made the association statistically not significant as many of the restorations had very good and good marginal adaptation.