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Gender association of restorative techniques performed for class II cavities in university hospital.

BHARATHI R[1], DEEPAK S[2*], SENTHIL MURUGAN P[3]

[1]Saveetha Dental college & Hospitals,Saveetha Institute of Medical and technical Science,Saveetha University, Chennai.
[2]Senior lecturer,Department of Conservative Dentistry and Endodontics,Saveetha Dental college & Hospitals, Saveetha Institute of Medical and technical Science,Saveetha University,Chennai.
[3]Associate professor,Department of Oral and Maxillofacial Surgery,Saveetha Dental college & Hospitals, Saveetha Institute of Medical and technical Science,Saveetha University,Chennai.
*Corresponding author
Email :151701041.sdc@saveetha.com[1], deepaks.sdc@saveetha.com[2], senthilmuruganp.sdc@saveetha.com[3]

Abstract: Class II dental caries involve decay of the proximal surfaces of premolars and molars. The most commonly used direct restoration techniques are amalgam and composite restoration which is directly performed onto the tooth to be restored. Teeth also can be restored using indirect techniques in which restorations are fabricated outside of the mouth.The most common indirect restoration techniques are cast metal and cast ceramic restorations. The aim of this study was to evaluate the gender association of restorative techniques performed for class II cavities in university hospital. Data of the patients were retrieved from the dental records. Patients with class II caries were shortlisted, gender and restoration techniques were studied. Total study sample was 1182 cases. Data was tabulated in excel and statistically analysed using the Chi Square test. In class II caries, amalgam restoration technique (79.7%) was the most commonly performed restoration technique followed by composite restoration technique (17.6%) and cast restoration technique (2.6%). This indicated that the most commonly performed technique was the direct restoration technique (97.4%) followed by indirect restoration technique (2.6%) and there was no significant gender association among the various types of fillings (P.0.05- chi square- statistically not significant). Within the limitation of this study, in patients with class II caries, the most commonly performed technique was the amalgam restoration technique followed by composite and cast restoration technique and there was no significant gender association among the restorations performed in this institutional study.

Keywords - Dental caries, amalgam, composite, cast restoration.

INTRODUCTION

Dental caries is a major oral health problem which is affecting 2.43 billion people (35.3% of the population) worldwide(Vos et al. 2012). Class II caries is the cavity on the proximal surfaces of premolars and molar- G.V. Black's classification. Most commonly used restoration techniques for class 2 cavities include amalgam, composite and cast restoration (inlay). Type of restoration for class II cavity depends on the remaining amount of healthy tooth structure and patients preference(Dablanca-Blanco et al. 2017). To evaluate the remaining dentine thickness which plays a major role in the selection of restoration technique, cone-beam computed tomography can be used(Ramanathan and Solete 2015). The efficiency of the diagnostic aids plays an important role in the planning of the treatment. Bitewing radiograph plays an important role in the diagnosis of class II caries(Janani, Palanivelu, and Sandhya 2020).

Amalgam is a restorative material especially suitable for classes I and II restorations in teeth that encounter heavy chewing forces. The advantages of amalgam restorations include excellent load bearing properties, resistance to wear, tolerance to a wide range of clinical placement conditions(Manhart, García-Godoy, and Hickel 2002). Amalgam restorations may also be known as the most widely and successfully used posterior restorative material till today. Reason for its popularity lies in its ease of manipulation, relatively low cost, and long clinical service life(Shashank, Ranga, and Chole 2010). However amalgam restorations may also cause changes in the intraoral environment due to secondary caries, fracture, marginal breakdown(Martin et al. 2013)(Manhart et al. 2004) and wear. It is also known to cause cytotoxicity, but the risk of side effects is low.

Composite resins are being widely used these days for restoring posterior teeth due to advances in the material aspect and adhesive resin technology(Behery et al. 2018). Restoring the peripheral seal especially in deep class II tooth preparations with the gingival margin extending on the root still remains a critical goal for adhesive dentistry(Sawani et al. 2014). Flowable composite resins improve marginal seal and reduce micro leakage(M. P. Kumar 2010). Disadvantages of composites include micro leakage, staining at the margins of the rectorations, recurrent caries, post op sensitivity, and development of pulpal and periapical pathology(Al-Saleh et al. 2010)(Cohen et al. 1998). Composites have been imposed as restorative alternatives due to their improved esthetic properties, improved adhesive capacity due to modern dentin adhesives and increased mechanical properties. Shortcomings of composite have been associated with stress generation on the tooth interface, as a consequence of shrinkage and tensile stress caused by occlusal loading. Polymerisation shrinkage proposes the problem of debonding, to address this flowable composite have been proposed as a restorative option, due to their low elasticity module(Hussainy et al. 2018). In case of deep cavities, remineralising agents are used as a liner to prevent post operative sensitivity, damage to pulp, recurrent decay(Teja, Ramesh, and Priya 2018) and enhanced remineralisation(Rajendran et al. 2019).

Inlay is indicated where high strength of cast restoration is required for the tooth. Inlay provides superior control of contact and contours. The cast restoration withstands occlusal forces of mastication and distributes the forces uniformly. It directs along the long axis of the tooth structure and thus it prevents tooth fracture . Inlay also conserves the intact facial and lingual enamel surfaces, thus the health of the surrounding periodontium is maintained and the gingiva attracts less plaque and thus prolongs the longevity of the restoration(Liu, Fok, and Li 2014).

Cast restorations yield compressive, tensile and shear strengths of alloys and ceramics. Casting technique and material are capable of reproducing precise form and minute detail. Metal alloys contain one or more of their component metals which is a noble or passivated metal providing a strong structure which is less susceptible to corrosion. Cast restorations can be finished, polished or glazed outside the oral cavity(Clyde 1986). Cast restoration being a cemented restoration, several inter phases will be created at the tooth- cement - casting junction and necessitate extensive tooth involvement in the preparation. It also causes galvanic deterioration. The procedure of this technique is lengthy requiring more than one visit with temporary coverage between visits. Some cast alloy and ceramics have a very high abrasive resistance, much more than that of tooth enamel(Volland 1927). Several researches lead to the increased advances in this field(Jose, P., and Subbaiyan 2020)(Nandakumar and Nasim 2018)(Noor, S Syed Shihaab, and Pradeep 2016)(Ramamoorthi, Nivedhitha, and Divyanand 2015)(24). Various invitro and invivo researches had been done that led to this study(Siddique et al. 2019)(Ravinthar and Jayalakshmi 2018)(Manohar and Sharma 2018)(R, Rajakeerthi, and Ms 2019; D. Kumar and Delphine Priscilla Antony 2018). The idea for this study stemmed from the current interest in our community.

Para1. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Rajeshkumar et al. 2019; Gomathi et al. 2020; Panchal, Jeevanandan, and Subramanian 2019; Dua et al. 2019; Ramakrishnan, Dhanalakshmi, and Subramanian 2019; Ezhilarasan, Apoorva, and Ashok Vardhan 2019; Duraisamy et al. 2019; Rajeshkumar et al. 2018; Varghese, Ramesh, and Veeraiyan 2019; Deogade, Gupta, and Ariga 2018; Ezhilarasan 2018; Ezhilarasan, Sokal, and Najimi 2018; Samuel, Acharya, and Rao 2020; Mehta et al. 2019; J et al. 2018; Sharma et al. 2019; Malli Sureshbabu et al. 2019; Rajendran et al. 2019; Jeevanandan and Govindaraju 2018; Menon et al. 2018; Vishnu Prasad et al. 2018; Wahab et al. 2018; Prabakar et al. 2018; Gheena and Ezhilarasan 2019)

The aim of this study was to evaluate the the gender association of restorative techniques performed for class II cavities in university hospital

MATERIALS AND METHODS

In this study a total of 1182 patients of all age groups and genders were considered. This study was conducted as a university setting including predominantly South Indian population. The approval of this study was provided by the institutional ethical board. This was a retrospective study in which the data of patients from June 2019 to April 2020 of all age groups and gender were collected from the dental records. All the cases were approved and verified by an external reviewer and cross verification was done using a photographic method to eliminate the errors made while recording. Inclusion criteria included the patients with class II caries visiting the hospital for treatment. Exclusion criteria included patients with other class caries visiting the hospital for treatment. Repeated and incomplete patients data were also excluded from this study.

The independent variables of this study were name, age, and ethnicity. Dependent variables were gender, class II caries and restoration procedure performed. Data obtained was tabulated in excel imported to SPSS by IBM

software with variables defined. Analysis of this study was done using a statistical test Chi Square and the results were interpreted.

RESULTS AND DISCUSSION

In this study the restoration for class II cavity was done as follows, 79.7% amalgam restoration technique, 17.6% composite restoration technique and 2.6% cast restoration technique(Figure 3). Therefore the most commonly performed restoration technique in class II caries was amalgam restoration technique. This indicated that the most commonly performed restoration technique was direct restoration technique (97.4%) followed by indirect restoration technique (2.6%) (Figure 1). Among all the techniques performed, 39.8% were amalgam MO, 38.7% were amalgam DO, 1.1% were amalgam MOD, 8.4% were composite MO, 8.9% were composite DO, 0.25% were amalgam MOD, 0.5% were metal inlay MO, 0.8% were metal inlay DO, 0.5% were ceramic inlay MO, 0.6% were ceramic inlay DO and 0.08% were composite inlay DO. Therefore amalgam MO was the most commonly performed restorative technique (Figure 5). The gender prevalence was almost equal in this study. Total number of males (n=583) in this study was almost equal to females (n=599) (Figure 2, 4,6) (Chi square test; p value >0.05, not significant).

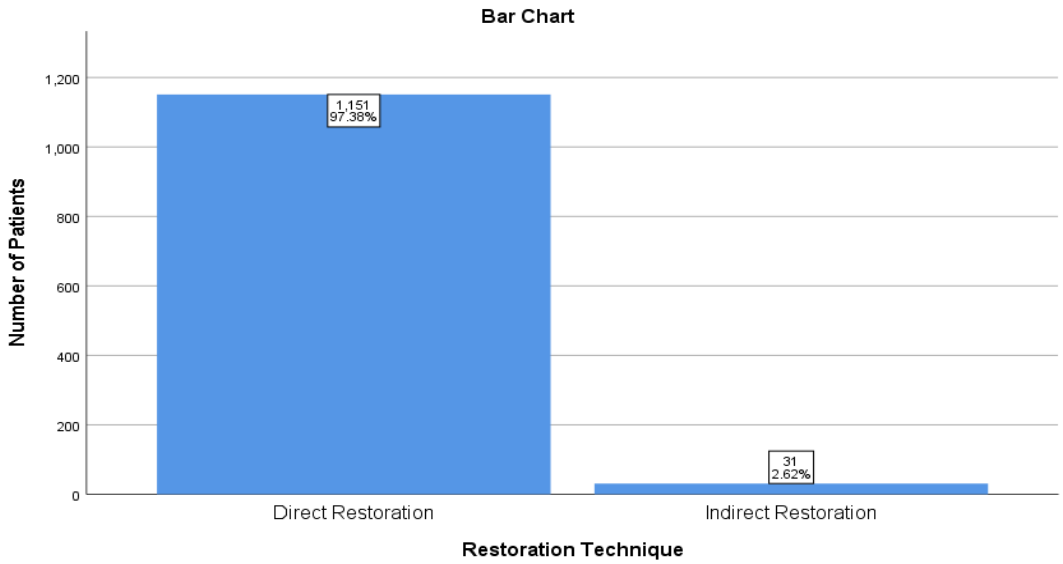

Fig.1- Bar graph represents the frequency distribution of the different restoration techniques. The x-axis represents the type of technique and the y-axis represents the number of patients. Bar graph shows the prevalence of direct restoration technique (97.4%), followed by indirect restoration technique (2.6%) in the spacing scale.

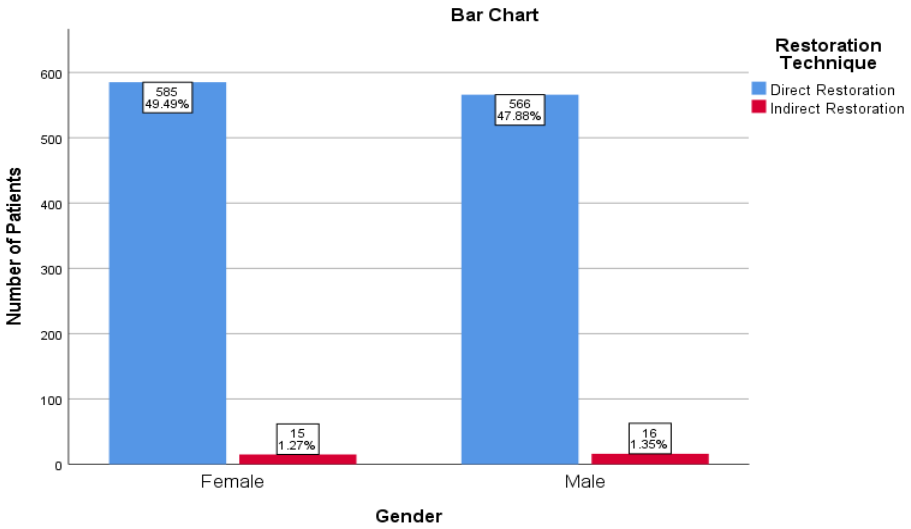

Fig.2:Bar graph represents the association between gender and restoration technique. The x-axis represents gender and y-axis represents the number of patients. The blue colour indicates direct restoration technique and red colour indicates indirect restoration technique. Chi-square test was done and association was statistically not significant. Pearson's Chi Square value: 0.072, DF: 1, p value: 0.789(>0.05) hence statistically not significant, proving there is no association between gender and restoration technique.

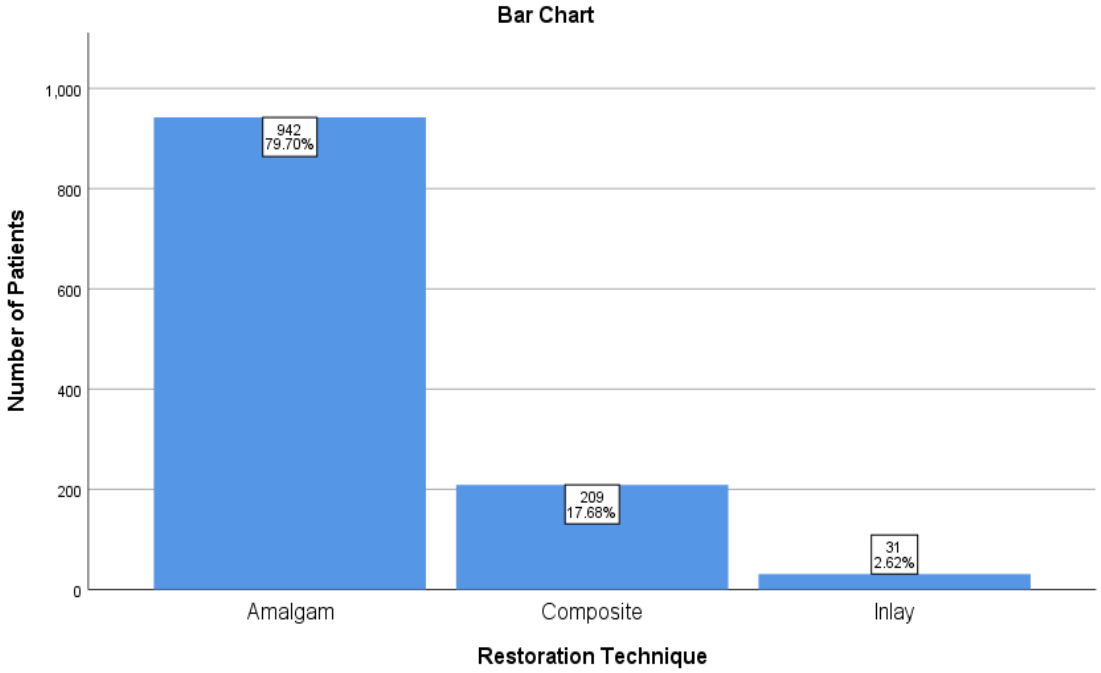

Fig.3 - Bar graph shows the prevalence of amalgam,composite and cast restoration. The x-axis represents different restorative materials and the y-axis represents the number of patients. Bar graph shows the prevalence of amalgam restoration technique (79.7%) followed by composite restoration technique (17.6%) and cast restoration technique (2.6%) in the spacing scale.

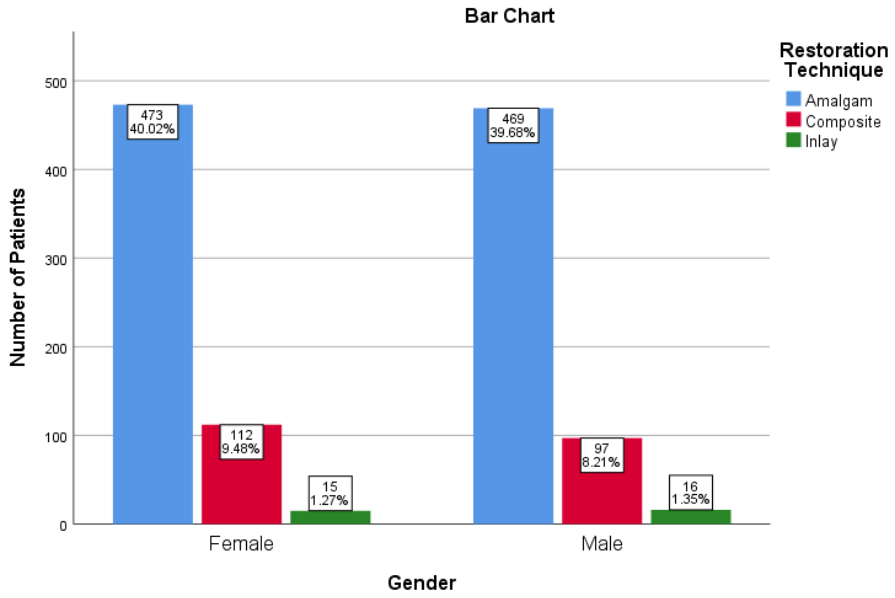

Fig.4:Bar graph represents the prevalence of amalgam, composite and cast restoration technique based on gender. The x-axis represents the gender and the y-axis represents the number of patients. The blue colour indicates amalgam restoration, red colour indicates composite restoration technique and green colour indicates cast restoration (inlay). No significant association between gender and the type of restoration. Chi-square test was done and association was statistically not significant. Pearson's Chi Square value: 0.852, DF: 2, p value: 0.653(>0.05) hence statistically not significant, proving there is no association between gender and restoration technique.

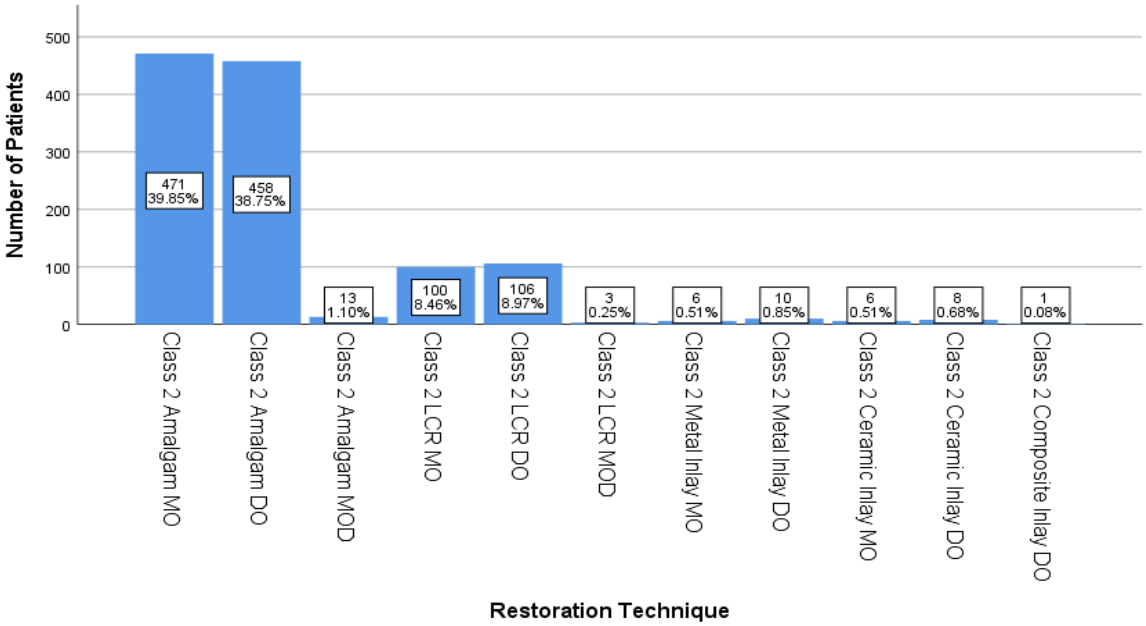

Fig.5:shows the prevalence of various types of restoration procedures. The x-axis represents the prevalence scale of amalgam(MO, DO, MOD), composite(MO, DO, MOD), metal inlay(MO, DO), ceramic inlay(MO, DO) and composite inlay(DO) and y-axis represents the number of patients. Bar graph shows the prevalence of amalgam MO(39.8%) in direct restoration technique and prevalence of metal inlay DO (0.8%) in indirect restoration technique in the spacing scale.

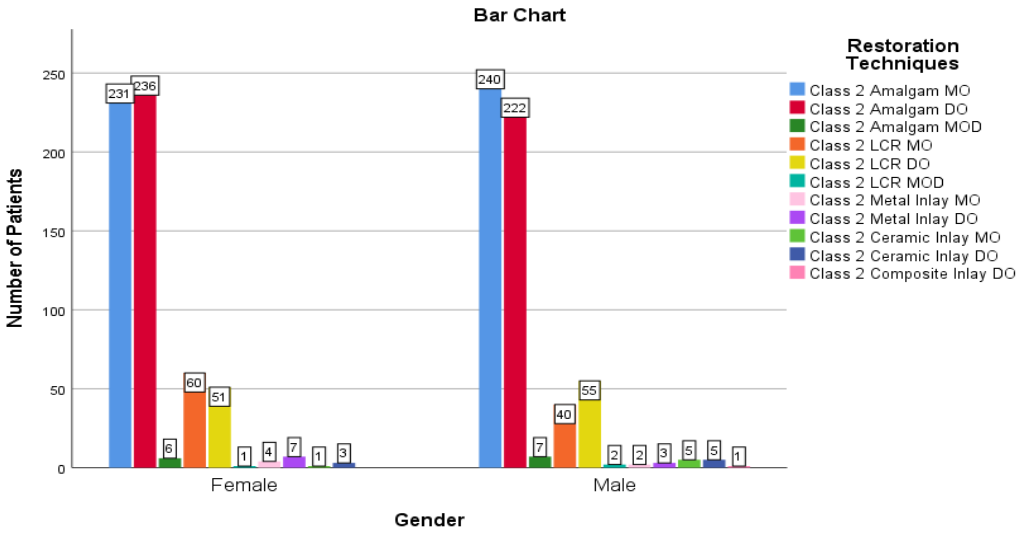

Fig.6 Bar graph represents the prevalence of various types of restoration procedures based on gender. The x-axis represents the prevalence scale of gender and y-axis represents the number of patients. Different colours in the graph indicate various restoration techniques. Chi-square test was done and association was statistically not significant. Pearson's Chi Square value: 11.323, DF: 10, p value: 0.333(>0.05) hence statistically not significant, proving there is no association between gender and restorative procedures.

ASSOCIATION BETWEEN GENDER AND RESTORATIVE TECHNIQUES (DIRECT AND INDIRECT)			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.072a	1	.789
Likelihood Ratio	.072	1	.789
Linear-by-Linear Association	.072	1	.789
N of Valid Cases	1182		
ASSOCIATION BETWEEN GENDER AND RESTORATIVE TECHNIQUES (AMALGAM, COMPOSITE AND INLAY)			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.852[a]	2	.653
Likelihood Ratio	.853	2	.653
Linear-by-Linear Association	.290	1	.590
N of Valid Cases	1182		
ASSOCIATION BETWEEN GENDER AND RESTORATIVE TECHNIQUES [AMALGAM (MO, DO, MOD), COMPOSITE (MO, DO, MOD) AND INLAY (METAL, CERAMIC, COMPOSITE)]			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.323	10	0.333
Likelihood Ratio	12.049	10	.282
Linear-by-Linear Association	.024	1	.877
N of Valid Cases	1182		

Fig.7 shows the chi-square analysis test results. P value is greater than 0.05 and the association is statistically not significant.

In amalgam, class II amalgam MO restoration was the most commonly performed restoration procedure among all other techniques. Amalgam is most preferred due to its moderate leakage, less incidence of recurrent decay, high resistance to wear, lower cost and require single visit, but it is not used in some cases due its brittleness, subject to chipping, allergic response, early sensitivity to hot and cold, non- esthetic. But it represented a 38% decline in its use and it drops three to five percent each year(Hume 1989). Amalgam was used in 53.3% of the direct restorations of posterior teeth(Smart 2002). This is in concordance with our study that amalgam is used in most of the posterior restoration and most preferable in class II restorations. Even with some of their disadvantages like non esthetic, allergy etc, amalgam restoration is preferred due to its advantages. The percentage of amalgam restoration done in females was 40.02% and males was 39.68% in this study and there was no association of gender in amalgam restoration technique.

The prevalent restoration technique followed by amalgam in class II cavity is composite restoration technique (17.6%). Flowable composite liner is more effective in sealing the gingival cavosurface margins of class II preparation compared to other groups, so composite is preferred(Behery et al. 2018). Due to aesthetic properties and good clinical service, composites have become the preferred material for direct posterior restoration(Burns, Barton, and Chandler 1969). In accordance with the previous literature, most of them preferred composite restoration due to its excellent aesthetic properties. Some denied it due to its decreased strength, recurrent decay, post operative sensitivity. The percentage of composite restoration done in class II caries in females were 9.48% and males were 8.21% in this study and there was no association of gender in composite restoration technique.

Cast restoration is the indirect restoration technique and 2.6% of the class II restoration was done by cast restoration technique. Best treatment for class II caries occuring in between two teeth is inlay cast restoration. The inlay is considered the best conservative restoration as it has the advantage of good compressive strength to withstand heavy masticatory forces(Liu, Fok, and Li 2014). The percentage of inlay cast restoration done in females was 1.27% and males was 1.35% in this study and there was no significant association of gender in inlay restoration technique.

The silver amalgam is the oldest restorative material with good compression strength but has the advantage of restoration fracture if it is a large cavity(Letzel et al. 1989). The composite is a tooth coloured restorative material but has the disadvantage of less strength, polymerisation shrinkage and hypersensitivity(Ruyter, Nilner, and Möller 1987). The cast restoration has high compressive and shear strength but has the disadvantage of extensive tooth involvement, lengthy procedure, multiple visits and galvanic restoration. Yet amalgam restoration is preferred over composite and cast restoration due to its major advantages of compressive strength, cost efficient, single visit procedure and longevity with less Incidence of secondary caries in class II posterior restoration. There was no previous study that shows the gender prevalence in restoration techniques. In this study there was no significant association of gender as the number of males were almost equal to the number of females in respective restorative techniques.

Drawback of this study is that the sample size is small and inadequate. This study included only the samples from some parts of south India. To ascertain the results of this study and to increase the significance level, sample size should be increased and the geographic coverage should extend at least to the most parts of South India. Future scope of this study is to conduct it as a multicentered study and increase the geographic limitation.

Our institution is passionate about high quality evidence based research and has excelled in various fields ((Vijayashree Priyadharsini 2019; Ezhilarasan, Apoorva, and Ashok Vardhan 2019; Ramesh et al. 2018; Mathew et al. 2020; Sridharan et al. 2019; Pc, Marimuthu, and Devadoss 2018; Ramadurai et al. 2019)

CONCLUSION

Within the limitations of this study, the most commonly performed restoration for class II was amalgam followed by composites and cast restorations and there was no significant gender association among the restorations performed.

REFERENCE

1. Al-Saleh, M., O. El-Mowafy, L. Tam, and A. Fenton. 2010. “Microleakage of Posterior Composite Restorations Lined with Self-Adhesive Resin Cements.” Operative Dentistry. https://doi.org/10.2341/09-189-l.
2. Behery, Haytham, Omar El-Mowafy, Wafa El-Badrawy, Sameh Nabih, and Belal Saleh. 2018. “Gingival Microleakage of Class II Bulk-Fill Composite Resin Restorations.” Dental and Medical Problems. https://doi.org/10.17219/dmp/99264.
3. Burns, Claire L., John A. Barton, and H. H. Chandler. 1969. “Characterization of a Composite Resin-Silica Material Developed for Temporary Posterior Restorations :” https://doi.org/10.6028/nbs.rpt.10065.
4. Clyde, J. S. 1986. “Clinical Procedures for Partial Crowns, Inlays, Onlays and Pontics: An Atlas.” Journal of Dentistry. https://doi.org/10.1016/0300-5712(86)90013-8.
5. Cohen, Brett I., Mark K. Pagnillo, Barry L. Musikant, and Allan S. Deutsch. 1998. “Shear Bond Strength of a

Titanium Reinforced Core Material after Using Multistep and Single-Step Bonding Agents." The Journal of Prosthetic Dentistry. https://doi.org/10.1016/s0022-3913(98)70130-1.

6. Dablanca-Blanco, Ana Belén, Juan Blanco-Carrión, Benjamín Martín-Biedma, Purificación Varela-Patiño, Alba Bello-Castro, and Pablo Castelo-Baz. 2017. "Management of Large Class II Lesions in Molars: How to Restore and When to Perform Surgical Crown Lengthening?" Restorative Dentistry & Endodontics 42 (3): 240–52.
7. Deogade, Suryakantc, Pushkar Gupta, and Padma Ariga. 2018. "Effect of Monopoly-Coating Agent on the Surface Roughness of a Tissue Conditioner Subjected to Cleansing and Disinfection: A Contact Profilometric In Vitro Study." Contemporary Clinical Dentistry. https://doi.org/10.4103/ccd.ccd_112_18.
8. Dua, Kamal, Ridhima Wadhwa, Gautam Singhvi, Vamshikrishna Rapalli, Shakti Dhar Shukla, Madhur D. Shastri, Gaurav Gupta, et al. 2019. "The Potential of siRNA Based Drug Delivery in Respiratory Disorders: Recent Advances and Progress." Drug Development Research 80 (6): 714–30.
9. Duraisamy, Revathi, Chitra Shankar Krishnan, Hariharan Ramasubramanian, Jayakrishnakumar Sampathkumar, Saravanakumar Mariappan, and Azhagarasan Navarasampatti Sivaprakasam. 2019. "Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments." Implant Dentistry 28 (3): 289–95.
10. Ezhilarasan, Devaraj. 2018. "Oxidative Stress Is Bane in Chronic Liver Diseases: Clinical and Experimental Perspective." Arab Journal of Gastroenterology: The Official Publication of the Pan-Arab Association of Gastroenterology 19 (2): 56–64.
11. Ezhilarasan, Devaraj, Velluru S. Apoorva, and Nandhigam Ashok Vardhan. 2019. "Syzygium Cumini Extract Induced Reactive Oxygen Species-Mediated Apoptosis in Human Oral Squamous Carcinoma Cells." Journal of Oral Pathology & Medicine: Official Publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology 48 (2): 115–21.
12. Ezhilarasan, Devaraj, Etienne Sokal, and Mustapha Najimi. 2018. "Hepatic Fibrosis: It Is Time to Go with Hepatic Stellate Cell-Specific Therapeutic Targets." Hepatobiliary & Pancreatic Diseases International: HBPD INT 17 (3): 192–97.
13. Gheena, S., and D. Ezhilarasan. 2019. "Syringic Acid Triggers Reactive Oxygen Species-Mediated Cytotoxicity in HepG2 Cells." Human & Experimental Toxicology 38 (6): 694–702.
14. Gomathi, A. C., S. R. Xavier Rajarathinam, A. Mohammed Sadiq, and S. Rajeshkumar. 2020. "Anticancer Activity of Silver Nanoparticles Synthesized Using Aqueous Fruit Shell Extract of Tamarindus Indica on MCF-7 Human Breast Cancer Cell Line." Journal of Drug Delivery Science and Technology. https://doi.org/10.1016/j.jddst.2019.101376.
15. Hume, W. R. 1989. "AMALGAM AND THE ALTERNATIVES." Australian Dental Journal. https://doi.org/10.1111/j.1834-7819.1989.tb04629.x.
16. Hussainy, Syed Nazia, Iffat Nasim, Toby Thomas, and Manish Ranjan. 2018. "Clinical Performance of Resin-Modified Glass Ionomer Cement, Flowable Composite, and Polyacid-Modified Resin Composite in Noncarious Cervical Lesions: One-Year Follow-Up." Journal of Conservative Dentistry: JCD 21 (5): 510–15.
17. Janani, Krishnamachari, Ajitha Palanivelu, and Raghu Sandhya. 2020. "Diagnostic Accuracy of Dental Pulse Oximeter with Customized Sensor Holder, Thermal Test and Electric Pulp Test for the Evaluation of Pulp Vitality - An in Vivo Study." Brazilian Dental Science. https://doi.org/10.14295/bds.2020.v23i1.1805.
18. Jeevanandan, G., and L. Govindaraju. 2018. "Clinical Comparison of Kedo-S Paediatric Rotary Files vs Manual Instrumentation for Root Canal Preparation in Primary Molars: A Double Blinded Randomised Clinical Trial." European Archives of Paediatric Dentistry. https://doi.org/10.1007/s40368-018-0356-6.
19. Jose, Jerry, Ajitha P., and Haripriya Subbaiyan. 2020. "Different Treatment Modalities Followed by Dental Practitioners for Ellis Class 2 Fracture – A Questionnaire-Based Survey." The Open Dentistry Journal. https://doi.org/10.2174/1874210602014010059.
20. J, Pradeep Christopher, Thenaruvi Marimuthu, Krithika C, Poorna Devadoss, and Santhosh M. Kumar. 2018. "Prevalence and Measurement of Anterior Loop of the Mandibular Canal Using CBCT: A Cross Sectional Study." Clinical Implant Dentistry and Related Research 20 (4): 531–34.
21. Kumar, Dhinesh, and S. Delphine Priscilla Antony. 2018. "Calcified Canal and Negotiation-A Review." Research Journal of Pharmacy and Technology. https://doi.org/10.5958/0974-360x.2018.00683.2.
22. Kumar, Mukka Pratap. 2010. "A STEREO MICROSCOPIC EVALUATION OF MICROLEAKAGE- LASER VERSUS VISIBLE LIGHT CURED CLASS V COMPOSITE RESIN RESTORATIONS – AN INVITRO STUDY." Annals and Essences of Dentistry. https://doi.org/10.5368/aedj.2011.3.1.1.3.
23. Letzel, H., M. A. van't Hof, M. M. A. Vrijhoef, G. W. Marshall, and S. J. Marshall. 1989. "Controlled Clinical Study of Amalgam Restorations: Survival, Failures, and Causes of Failure." Dental Materials. https://doi.org/10.1016/0109-5641(89)90141-3.

24. Liu, Xiaozhou, Alex Fok, and Haiyan Li. 2014. "Influence of Restorative Material and Proximal Cavity Design on the Fracture Resistance of MOD Inlay Restoration." Dental Materials. https://doi.org/10.1016/j.dental.2013.12.006.
25. Malli Sureshbabu, Nivedhitha, Kathiravan Selvarasu, Jayanth Kumar V, Mahalakshmi Nandakumar, and Deepak Selvam. 2019. "Concentrated Growth Factors as an Ingenious Biomaterial in Regeneration of Bony Defects after Periapical Surgery: A Report of Two Cases." Case Reports in Dentistry 2019 (January): 7046203.
26. Manhart, Juergen, Hongyan Chen, Gerald Hamm, and Reinhard Hickel. 2004. "Buonocore Memorial Lecture. Review of the Clinical Survival of Direct and Indirect Restorations in Posterior Teeth of the Permanent Dentition." Operative Dentistry 29 (5): 481–508.
27. Manhart, Juergen, Franklin García-Godoy, and Reinhard Hickel. 2002. "Direct Posterior Restorations: Clinical Results and New Developments." Dental Clinics of North America. https://doi.org/10.1016/s0011-8532(01)00010-6.
28. Manohar, Madhu Priya, and Subash Sharma. 2018. "A Survey of the Knowledge, Attitude, and Awareness about the Principal Choice of Intracanal Medicaments among the General Dental Practitioners and Nonendodontic Specialists." Indian Journal of Dental Research: Official Publication of Indian Society for Dental Research 29 (6): 716–20.
29. Martin, Javier, Eduardo Fernandez, Juan Estay, Valeria V. Gordan, Ivar Andreas Mjör, and Gustavo Moncada. 2013. "Management of Class I and Class II Amalgam Restorations with Localized Defects: Five-Year Results." International Journal of Dentistry. https://doi.org/10.1155/2013/450260.
30. Mathew, M. G., S. R. Samuel, A. J. Soni, and K. B. Roopa. 2020. "Evaluation of Adhesion of Streptococcus Mutans, Plaque Accumulation on Zirconia and Stainless Steel Crowns, and Surrounding Gingival Inflammation in Primary …." Clinical Oral Investigations. https://link.springer.com/article/10.1007/s00784-020-03204-9.
31. Mehta, Meenu, Deeksha, Devesh Tewari, Gaurav Gupta, Rajendra Awasthi, Harjeet Singh, Parijat Pandey, et al. 2019. "Oligonucleotide Therapy: An Emerging Focus Area for Drug Delivery in Chronic Inflammatory Respiratory Diseases." Chemico-Biological Interactions 308 (August): 206–15.
32. Menon, Soumya, Shrudhi Devi Ks, R. Santhiya, S. Rajeshkumar, and Venkat Kumar S. 2018. "Selenium Nanoparticles: A Potent Chemotherapeutic Agent and an Elucidation of Its Mechanism." Colloids and Surfaces B: Biointerfaces. https://doi.org/10.1016/j.colsurfb.2018.06.006.
33. Nandakumar, Mahalakshmi, and Iffat Nasim. 2018. "Comparative Evaluation of Grape Seed and Cranberry Extracts in Preventing Enamel Erosion: An Optical Emission Spectrometric Analysis." Journal of Conservative Dentistry: JCD 21 (5): 516–20.
34. Noor, S. Syed Shihaab E., S Syed Shihaab, and Pradeep. 2016. "Chlorhexidine: Its Properties and Effects." Research Journal of Pharmacy and Technology. https://doi.org/10.5958/0974-360x.2016.00353.x.
35. Panchal, V., G. Jeevanandan, and E. M. G. Subramanian. 2019. "Comparison of Post-Operative Pain after Root Canal Instrumentation with Hand K-Files, H-Files and Rotary Kedo-S Files in Primary Teeth: A Randomised Clinical Trial." European Archives of Paediatric Dentistry: Official Journal of the European Academy of Paediatric Dentistry 20 (5): 467–72.
36. Pc, J., T. Marimuthu, and P. Devadoss. 2018. "Prevalence and Measurement of Anterior Loop of the Mandibular Canal Using CBCT: A Cross Sectional Study." Clinical Implant Dentistry and Related Research. https://europepmc.org/article/med/29624863.
37. Prabakar, Jayashri, Joseph John, I. Meignana Arumugham, R. Pradeep Kumar, and D. Srisakthi. 2018. "Comparative Evaluation of Retention, Cariostatic Effect and Discoloration of Conventional and Hydrophilic Sealants - A Single Blinded Randomized Split Mouth Clinical Trial." Contemporary Clinical Dentistry 9 (Suppl 2): S233–39.
38. Rajendran, Ratheesh, Radhakrishnan Nair Kunjusankaran, Raghu Sandhya, Aadit Anilkumar, Rakhi Santhosh, and Santosh Rayagouda Patil. 2019. "Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study." Pesquisa Brasileira Em Odontopediatria E Clínica Integrada. https://doi.org/10.4034/pboci.2019.191.61.
39. Rajeshkumar, S., S. Venkat Kumar, Arunachalam Ramaiah, Happy Agarwal, T. Lakshmi, and Selvaraj Mohana Roopan. 2018. "Biosynthesis of Zinc Oxide Nanoparticles usingMangifera Indica Leaves and Evaluation of Their Antioxidant and Cytotoxic Properties in Lung Cancer (A549) Cells." Enzyme and Microbial Technology 117 (October): 91–95.
40. Rajeshkumar, S., Soumya Menon, S. Venkat Kumar, Murtaza M. Tambuwala, Hamid A. Bakshi, Meenu Mehta, Saurabh Satija, et al. 2019. "Antibacterial and Antioxidant Potential of Biosynthesized Copper Nanoparticles Mediated through Cissus Arnotiana Plant Extract." Journal of Photochemistry and Photobiology. B, Biology

197 (August): 111531.
41. Ramadurai, Neeraja, Deepa Gurunathan, A. Victor Samuel, Emg Subramanian, and Steven J. L. Rodrigues. 2019. "Effectiveness of 2% Articaine as an Anesthetic Agent in Children: Randomized Controlled Trial." Clinical Oral Investigations 23 (9): 3543–50.
42. Ramakrishnan, Mahesh, R. Dhanalakshmi, and E. M. G. Subramanian. 2019. "Survival Rate of Different Fixed Posterior Space Maintainers Used in Paediatric Dentistry - A Systematic Review." The Saudi Dental Journal 31 (2): 165–72.
43. Ramamoorthi, Surendar, Malli Sureshbabu Nivedhitha, and Madras Jeyaprakash Divyanand. 2015. "Comparative Evaluation of Postoperative Pain after Using Endodontic Needle and EndoActivator during Root Canal Irrigation: A Randomised Controlled Trial." Australian Endodontic Journal: The Journal of the Australian Society of Endodontology Inc 41 (2): 78–87.
44. Ramanathan, Suhashini, and Pradeep Solete. 2015. "Cone-Beam Computed Tomography Evaluation of Root Canal Preparation Using Various Rotary Instruments: An in Vitro Study." The Journal of Contemporary Dental Practice. https://doi.org/10.5005/jp-journals-10024-1773.
45. Ramesh, Asha, Sheeja Varghese, Nadathur D. Jayakumar, and Sankari Malaiappan. 2018. "Comparative Estimation of Sulfiredoxin Levels between Chronic Periodontitis and Healthy Patients - A Case-Control Study." Journal of Periodontology 89 (10): 1241–48.
46. Ravinthar, Karishma, and Jayalakshmi. 2018. "Recent Advancements in Laminates and Veneers in Dentistry." Research Journal of Pharmacy and Technology. https://doi.org/10.5958/0974-360x.2018.00148.8.
47. R, Rajakeerthi, R. Rajakeerthi, and Nivedhitha Ms. 2019. "Natural Product as the Storage Medium for an Avulsed Tooth – A Systematic Review." Cumhuriyet Dental Journal. https://doi.org/10.7126/cumudj.525182.
48. Ruyter, I. E., K. Nilner, and B. Möller. 1987. "Color Stability of Dental Composite Resin Materials for Crown and Bridge Veneers." Dental Materials. https://doi.org/10.1016/s0109-5641(87)80081-7.
49. Samuel, Srinivasan Raj, Shashidhar Acharya, and Jeevika Chandrasekar Rao. 2020. "School Interventions-Based Prevention of Early-Childhood Caries among 3-5-Year-Old Children from Very Low Socioeconomic Status: Two-Year Randomized Trial." Journal of Public Health Dentistry 80 (1): 51–60.
50. Sawani, Shefali, Vipin Arora, Shikha Jaiswal, and Vineeta Nikhil. 2014. "Comparative Evaluation of Microleakage in Class II Restorations Using Open vs. Closed Centripetal Build-up Techniques with Different Lining Materials." Journal of Conservative Dentistry. https://doi.org/10.4103/0972-0707.136450.
51. Sharma, Parvarish, Meenu Mehta, Daljeet Singh Dhanjal, Simran Kaur, Gaurav Gupta, Harjeet Singh, Lakshmi Thangavelu, et al. 2019. "Emerging Trends in the Novel Drug Delivery Approaches for the Treatment of Lung Cancer." Chemico-Biological Interactions 309 (August): 108720.
52. Shashank, Kundoor, Banthu Ranga, and Dayanandgopalrao Chole. 2010. "An Evaluation of the Fracture Resistance of Class 2 Amalgam Restorations with Different Cavity Designs on Maxillary Premolars." Journal of the International Clinical Dental Research Organization. https://doi.org/10.4103/2231-0754.95261.
53. Siddique, Riluwan, Nivedhitha Malli Sureshbabu, Jayalakshmi Somasundaram, Benoy Jacob, and Deepak Selvam. 2019. "Qualitative and Quantitative Analysis of Precipitate Formation Following Interaction of Chlorhexidine with Sodium Hypochlorite, Neem, and Tulsi." Journal of Conservative Dentistry: JCD 22 (1): 40–47.
54. Smart, E. R. 2002. "A Survey of Amalgam Restorations in Taiwan." British Dental Journal. https://doi.org/10.1038/sj.bdj.4801586.
55. Sridharan, Gokul, Pratibha Ramani, Sangeeta Patankar, and Rajagopalan Vijayaraghavan. 2019. "Evaluation of Salivary Metabolomics in Oral Leukoplakia and Oral Squamous Cell Carcinoma." Journal of Oral Pathology & Medicine: Official Publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology 48 (4): 299–306.
56. Teja, Kavalipurapu Venkata, Sindhu Ramesh, and Vishnu Priya. 2018. "Regulation of Matrix Metalloproteinase-3 Gene Expression in Inflammation: A Molecular Study." Journal of Conservative Dentistry: JCD 21 (6): 592–96.
57. Varghese, Sheeja Saji, Asha Ramesh, and Deepak Nallaswamy Veeraiyan. 2019. "Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students." Journal of Dental Education 83 (4): 445–50.
58. Vijayashree Priyadharsini, Jayaseelan. 2019. "In Silico Validation of the Non-Antibiotic Drugs Acetaminophen and Ibuprofen as Antibacterial Agents against Red Complex Pathogens." Journal of Periodontology 90 (12): 1441–48.
59. Vishnu Prasad, S., Madan Kumar, Mahesh Ramakrishnan, and Dhanalakshmi Ravikumar. 2018. "Report on Oral Health Status and Treatment Needs of 5-15 Years Old Children with Sensory Deficits in Chennai, India."

Special Care in Dentistry: Official Publication of the American Association of Hospital Dentists, the Academy of Dentistry for the Handicapped, and the American Society for Geriatric Dentistry 38 (1): 58–59.
60. Volland, R. H. 1927. "The Use of Cast Gold Inlays as Bridge Abutments**Read before the Section on Partial Denture Prosthesis (Including Crown and Bridge Work) at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926." The Journal of the American Dental Association (1922). https://doi.org/10.14219/jada.archive.1927.0152.
61. Vos, Theo, Abraham D. Flaxman, Mohsen Naghavi, Rafael Lozano, Catherine Michaud, Majid Ezzati, Kenji Shibuya, et al. 2012. "Years Lived with Disability (YLDs) for 1160 Sequelae of 289 Diseases and Injuries 1990-2010: A Systematic Analysis for the Global Burden of Disease Study 2010." The Lancet 380 (9859): 2163–96.
62. Wahab, P. U. Abdul, Marimuthu Madhulaxmi, Periyasamy Senthilnathan, Marimuthu Ramaswamy Muthusekhar, Yogaen Vohra, and Rajendra Prabhu Abhinav. 2018. "Scalpel Versus Diathermy in Wound Healing After Mucosal Incisions: A Split-Mouth Study." Journal of Oral and Maxillofacial Surgery: Official Journal of the American Association of Oral and Maxillofacial Surgeons 76 (6): 1160–64.
63. Teja KV, Ramesh S. Shape optimal and clean more. Saudi Endodontic Journal. 2019 Sep 1;9(3):235