

PREVALENCE OF DIFFERENT FULL VENEER CROWNS IN A UNIVERSITY HOSPITAL SETTING

Sanjog Agarwal¹, V. Ashok², Subhabrata Maiti³

¹Saveetha dental college and hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-600077, TamilNadu, India.

²Professor and Head of Department, Department of Prosthodontics, Saveetha dental college and hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-600077, TamilNadu India.

³Senior lecturer, Department of Prosthodontics, Saveetha dental college and hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-600077, TamilNadu, India.

¹151909002.sdc@saveetha.com

²ashok@saveetha.com

³subhabratamaiti.sdc@saveetha.com

ABSTRACT

Recent advances in ceramics have greatly improved the functional and esthetic properties of restorative materials. New materials offer an esthetic and functional oral rehabilitation, however their impact on opposing teeth is not well documented. The aim of the study was to evaluate prevalence of different materials for full veneer crowns used by dentists for a single full veneer crown based on location and choice made by dentist. A Cross-sectional, descriptive study was conducted in an institution, on randomly selected individuals. The study group consisted of adult patients who attended the outpatient Department of Prosthodontics from June 2019- March 2020. 86000 case sheets were evaluated and frequency distribution test was used to explore the relationship between two variables. Comparison of the groups showed that Hand layered zirconia crown was preferred by 42.3 % individuals. Metal ceramic was preferred by 10.3% of the individuals. Monolithic zirconia was preferred by 47.4 % of the individuals. With the era of metal free crowns monolithic is preferred to solve the chipping problems which are to be considered before getting a hand layered zirconia crown or a metal ceramic crown.

KEY WORDS: CAD/CAM; Hand layered crowns; Monolithic crowns; Zirconia

INTRODUCTION

Since the introduction of the first ceramic crowns at the beginning of the 20th century, a constant progression occurred in materials and technologies in an attempt to look for an optimal solution to esthetic demand, as well as to avoid the disadvantage of the traditional manufacturing method. But since 1990s and mostly 2000s it was a great development in the field of dental ceramics, due to the high esthetic demand of the patients and in an attempt to improve the mechanical properties of the ceramics, specially to fabricate posterior fixed dental prostheses (FDPs). Therefore, research focused interest in computer aided design-computer aided manufacturing (CAD/CAM) zirconia ceramic (Komine, Blatz and Matsumura, 2010; Peláez *et al.*, 2012; Lopez-Suarez *et al.*, 2016). Zirconia ceramic has excellent mechanical properties (Anusavice, Shen and Ralph Rawls, 2014), however is highly opaque due to its completely crystalline microstructure, thus the framework must be covered with

veneering porcelain for more acceptable esthetic outcome (Rodríguez *et al.*, 2016; Jyothi *et al.*, 2017; Ariga *et al.*, 2018). But regardless of the high strength of the zirconia ceramic, one of the most important clinical problems is the chipping of the veneering ceramic according to the different clinic studies. (Al-Amleh, Lyons and Swain, 2010; Peláez *et al.*, 2012; Sailer *et al.*, 2017) This complication creates an uncertainty as regards the long-term clinical behavior of the zirconia bi-layered restorations (Raigrodski *et al.*, 2012). Several efforts have been made to reinforce or to improve the fracture strength of the veneering ceramic such as high strength CAD/CAM ceramic (Beuer *et al.*, 2009; Duraisamy *et al.*, 2019), press ceramic (Aboushelib, Kleverlaan and Feilzer, 2006; Kanat *et al.*, 2014) or “double veneering” (Aboushelib, Kleverlaan and Feilzer, 2008). Monolithic zirconia has been recently introduced to avoid the bi-layered systems’, however its behavior and chemical stability have not yet been fully clarified (Aboushelib, Kleverlaan and Feilzer, 2008; Mitov *et al.*, 2016).

Metal-ceramic prosthesis are considered as the gold standard in dentistry, with reasonable esthetics (Donovan and Swift, 2009; Selvan and Ganapathy, 2016). Long Term structural performance is well documented (Napankangas, Salonen and Raustia, 1997; Donovan and Swift, 2009; Silva *et al.*, 2010). High Gold alloys are still classified as alloys of choice, with high tensile strength and fracture toughness, resistance to wear (low friction coefficients), and resistance to corrosion in the oral environment (Donovan and Swift, 2009; Ganapathy *et al.*, 2016; Selvan and Ganapathy, 2016; Subasree, Murthykumar and Dhanraj, 2016). All-ceramic dental materials can demonstrate very different material properties. This can be related to variations in their chemical composition as well as in their structures (O. Addison, Marquis and Fleming, 2007; Owen Addison, Marquis and Fleming, 2007). Excellent esthetic characteristics and optimal mechanical properties are mandatory for an ideal all-ceramic material. Flexural strength, fracture toughness and limited crack propagation at the functional and parafunctional load conditions ensure lifetime serviceability (Zarone, Russo and Sorrentino, 2011; Vijayalakshmi and Ganapathy, 2016; Jain, Ranganathan and Ganapathy, 2017). To date, an inverse proportion between strength (i.e., the mechanical performance) and optical properties (i.e., the esthetic appearance) remains a predominant equation. Three different groups of ceramics are produced for dental usage: glass ceramics, glass infiltrated ceramics and polycrystalline ceramics. The aim of the study was to evaluate prevalence of different materials for full veneer crowns used by dentists for a single full veneer crown based on location and choice made by dentist.

MATERIAL AND METHODS

The study setting for this study is a university study setting which was done on Indian population to study prevalence between choice of impression technique among prosthodontists and implantologists. Approval for the study was taken from the Institutional ethical review board (SDC/SIHEC/2020/DIASDATA/0619-0320).

The data included in the study was from June 2019-March 2020. 86000 case sheets were reviewed. Cross verification of data was done through telephonic & photographic information. Measures which are taken to minimize sampling bias are simple random sampling. Sample size of 9326 was selected for the study.

Data collection from the database of Saveetha dental college all the case sheets were reviewed and hence a final number of patients were selected for the study. Patients who reported in the Department of Prosthodontics were selected for the study. Google sheet tabulation and SPSS importing of the data was done.

Descriptive statistics tests were performed. Software used - SPSS version 26 was used. Independent variable being race, age and time; Dependent variable being sex and choice for treatment. Frequency analysis was used to evaluate the data.

RESULTS AND DISCUSSION

There is more prevalence of monolithic crown (47.36%) in comparison to hand layered zirconia(42.34%), and metal ceramic crown(10.29%)(Figure 1). There is statistically significant association between different types of crowns of and their location(anterior/posterior), Hand layered zirconia crowns are mostly preferred for anterior teeth whereas monolithic zirconia is mostly preferred for posterior teeth, Pearson Chi Square value=49.5, p value=0.001($p < 0.05$, statistical significant)(Figure 2)(Table 1). There is statistically no significant association between different types of crowns of and their choice made by undergraduates/postgraduates, both undergraduates and postgraduates feel hand layered zirconia is the preferred material for crown followed by monolithic, metal ceramic is comparatively less in use, Pearson Chi Square value =1.30, p value=0.522 ($p > 0.05$)(Figure 3)(Table 1).

Porcelain-fused-to-metal (PFM) has been used for many years and studied extensively. Studies have demonstrated a 94% success rate over a 10-year period (Griggs, 2007; Ganapathy, Kannan and Venugopalan, 2017) and good long-term clinical reliability (Griggs, 2007; Lekesiz, 2014). Although chipping of veneering porcelain is a possible complication, fracture of the metal framework is uncommon(Sailer *et al.*, 2016). PFM restorations require sufficient tooth reduction to allow space for at least 0.3 mm of metal coping and 0.7 mm of veneering porcelain, and a minimum facial reduction of 1.2 mm according to Hobo and Shillingburg (Hobo and Shillingburg, 1973; Sailer *et al.*, 2016). When comparing PFM crowns to zirconia crowns, several points are noteworthy. Laboratory testing has determined that the fracture strength of a PFM crown using 1.5 mm reduction is similar to zirconia crowns with only 1 mm of reduction (Sun *et al.*, 2014; Ashok and Suvitha, 2016). Some manufacturers have even suggested a 0.6 mm minimum reduction for posterior zirconia crowns, which has led some dentists to prescribe all-zirconia restorations to preserve tooth structure (Baladhandayutham, Lawson and Burgess, 2015). Metal ceramic was preferred by 10.3% of the individuals. Metal crowns are among the strongest options, although their major disadvantage is esthetics. Full-metal restorations are often considered the gold standard in dentistry due to their excellent biocompatibility and strength. However, the increasing price of precious metals and patients' demands for esthetics have limited the use of both PFM and full metal restorations(Crisp *et al.*, 2008; Ashok *et al.*, 2014), which could make profitability an important aspect in the dentists' decision on crown material.

Hand layered zirconia crown was preferred by 42.3 % individuals All-zirconia crowns have gained popularity due to their high strength (Homaei *et al.*, 2016) and toughness(Quinn, Sundar and Lloyd, 2003; Homaei *et al.*, 2016), wear compatibility(Venugopalan *et al.*, 2014; Thompson, 2016; Kannan and Venugopalan, 2018) with natural dentition and low cost. However, some dentists may decide against this material due to its relative opaqueness and fear of long-term strength degradation from low temperature degradation (Chevalier, Gremillard and Deville, 2007; Thompson, 2016; Basha, Ganapathy and Venugopalan, 2018). Zirconia layered with a translucent ceramic, such as porcelain, is considered a more esthetic crown option, but the relatively low coefficient of thermal expansion and thermal diffusivity of zirconia compared to traditional metal coping materials led to laboratory complications. These manifested as veneer chipping(Christensen and Ploeger, 2010; Naenni *et al.*, 2015; Sailer *et al.*, 2017) and delamination over time (Håff *et al.*, 2015; Ajay *et al.*, 2017).

This problem was resolved by gradually introducing the monolithic zirconia crown into clinical practice. Monolithic zirconia was preferred by 47.4 % of the individuals. The monolithic zirconia crown restoration is fabricated with computer-aided design and computer-aided manufacturing (CAD/CAM) technique with the removal of veneering porcelain. It is made from a single piece of monolithic zirconium oxide ceramic ingot by computer numerical controlled cutting and sintering. The fabricated crowns have high flexural strength and high fracture toughness, both of which are remarkably better than those of the

alumina-based ceramic crowns(Candido *et al.*, 2018) The mechanical properties of monolithic zirconia restorative material are notably superior to those of other all-ceramic restorative materials, as the risk of chipping of porcelain veneers caused by chewing hard foods can be avoided(Schatz *et al.*, 2016). Besides, the monolithic zirconia crown restoration requires a less amount of tooth structure trimming compared with the all-ceramic crown retaining a more natural tooth structure(Schatz *et al.*, 2016).

In my opinion metal ceramic crowns have been extensively studied and are considered to be the gold standard but due to various problems of the chipping if the veneered ceramic monolithic zirconia is slowly taking over but since it being a new material has been less studied only a few clinical studies have reported on the periodontal conditions and the therapeutic effects of the restorations on the abutment and the antagonist teeth after the monolithic zirconia crowns were placed in patients(Bömicke *et al.*, 2017; Kitaoka *et al.*, 2018; Miura *et al.*, 2018). so more extensive research has to be done.

CONCLUSION

Hand layered zirconia crowns are mostly preferred for anterior teeth, to overcome the problems associated with chipping of the ceramic material monolithic crowns have taken over as the most preferred crowns for the posterior region. “No current material can fulfill all of the requirements of an ideal restorative material, considering esthetic, mechanical and economic demands. Decisions for crown material may be influenced by factors unrelated to tooth and patient variables”. Dentists should be cognizant of this when developing an evidence-based approach to selecting crown material.

AUTHOR CONTRIBUTIONS

First author, Dr. Sanjog Agarwal ,performed the analysis,interception and wrote the manuscript.Second author Dr. V.Ashok contributed to conception, data design, analysis interpretation and critically revised manuscript.The third author Dr. Subhabrata Maiti revised the manuscript as per guidelines, alignments and formatting. All the authors have discussed the results and contributed to the final manuscript.

CONFLICT OF INTEREST

There was no conflict of interests.

REFERENCES

- [1] Aboushelib, M., Kleverlaan, C. and Feilzer, A. (2006) ‘Microtensile bond strength of different components of core veneered all-ceramic restorationsPart II: Zirconia veneering ceramics’, *Dental Materials*, pp. 857–863. doi: 10.1016/j.dental.2005.11.014.
- [2] Aboushelib, M. N., Kleverlaan, C. J. and Feilzer, A. J. (2008) ‘Microtensile bond strength of different components of core veneered all-ceramic restorations. Part 3: double veneer technique’, *Journal of prosthodontics: official journal of the American College of Prosthodontists*, 17(1), pp. 9–13.
- [3] Addison, O., Marquis, P. M. and Fleming, G. J. P. (2007) ‘Resin Elasticity and the Strengthening of All-ceramic Restorations’, *Journal of Dental Research*, pp. 519–523. doi: 10.1177/154405910708600606.
- [4] Addison, O., Marquis, P. M. and Fleming, G. J. P. (2007) ‘Resin strengthening of dental ceramics—The impact of surface texture and silane’, *Journal of Dentistry*, pp. 416–424. doi: 10.1016/j.jdent.2006.11.012.
- [5] Ajay, R. et al. (2017) ‘Effect of surface modifications on the retention of cement-retained implant crowns under fatigue loads: An In vitro study’, *Journal of Pharmacy And Bioallied Sciences*, p. 154. doi: 10.4103/jpbs.jpbs_146_17.
- [6] Al-Amleh, B., Lyons, K. and Swain, M. (2010) ‘Clinical trials in zirconia: a systematic review’, *Journal of Oral Rehabilitation*. doi: 10.1111/j.1365-2842.2010.02094.x.

- [7] Anusavice, K. J., Shen, C. and Ralph Rawls, H. (2014) *Phillips' Science of Dental Materials - E-Book*. Elsevier Health Sciences.
- [8] Ariga, P. et al. (2018) 'Determination of Correlation of Width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A Systematic Review', *World Journal of Dentistry*, pp. 68–75. doi: 10.5005/jp-journals-10015-1509.
- [9] Ashok, V. et al. (2014) 'Lip Bumper Prosthesis for an Acromegaly Patient: A Clinical Report', *The Journal of Indian Prosthodontic Society*, pp. 279–282. doi: 10.1007/s13191-013-0339-6.
- [10] Ashok, V. and Suvitha, S. (2016) 'Awareness of all ceramic restoration in rural population', *Research Journal of Pharmacy and Technology*, p. 1691. doi: 10.5958/0974-360x.2016.00340.1.
- [11] Baladhandayutham, B., Lawson, N. C. and Burgess, J. O. (2015) 'Fracture load of ceramic restorations after fatigue loading', *The Journal of Prosthetic Dentistry*, pp. 266–271. doi: 10.1016/j.prosdent.2015.03.006.
- [12] Basha, F. Y. S., Ganapathy, D. and Venugopalan, S. (2018) 'Oral Hygiene Status among Pregnant Women', *Research Journal of Pharmacy and Technology*, p. 3099. doi: 10.5958/0974-360x.2018.00569.3.
- [13] Beuer, F. et al. (2009) 'High-strength CAD/CAM-fabricated veneering material sintered to zirconia copings — A new fabrication mode for all-ceramic restorations', *Dental Materials*, pp. 121–128. doi: 10.1016/j.dental.2008.04.019.
- [14] Bömicke, W. et al. (2017) 'Short-Term Prospective Clinical Evaluation of Monolithic and Partially Veneered Zirconia Single Crowns', *Journal of Esthetic and Restorative Dentistry*, pp. 22–30. doi: 10.1111/jerd.12270.
- [15] Candido, L. M. et al. (2018) 'Mechanical and Surface Properties of Monolithic Zirconia', *Operative Dentistry*, pp. E119–E128. doi: 10.2341/17-019-1.
- [16] Chevalier, J., Gremillard, L. and Deville, S. (2007) 'Low-Temperature Degradation of Zirconia and Implications for Biomedical Implants', *Annual Review of Materials Research*, pp. 1–32. doi: 10.1146/annurev.matsci.37.052506.084250.
- [17] Christensen, R. P. and Ploeger, B. J. (2010) 'A Clinical Comparison of Zirconia, Metal and Alumina Fixed-Prosthesis Frameworks Veneered With Layered or Pressed Ceramic', *The Journal of the American Dental Association*, pp. 1317–1329. doi: 10.14219/jada.archive.2010.0076.
- [18] Crisp, R. J. et al. (2008) 'A clinical evaluation of all-ceramic bridges placed in UK general dental practices: first-year results', *British Dental Journal*, pp. 477–482. doi: 10.1038/sj.bdj.2008.937.
- [19] Donovan, T. E. and Swift, E. J. (2009) 'PORCELAIN-FUSED-TO-METAL (PFM) ALTERNATIVES', *Journal of Esthetic and Restorative Dentistry*, pp. 4–6. doi: 10.1111/j.1708-8240.2008.00222.x.
- [20] Duraisamy, R. et al. (2019) 'Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments', *Implant dentistry*, 28(3), pp. 289–295.
- [21] Ganapathy, D. et al. (2016) 'Effect of Resin Bonded Luting Agents Influencing Marginal Discrepancy in All Ceramic Complete Veneer Crowns', *Journal of clinical and diagnostic research: JCDR*, 10(12), pp. ZC67–ZC70.
- [22] Ganapathy, D. M., Kannan, A. and Venugopalan, S. (2017) 'Effect of Coated Surfaces influencing Screw Loosening in Implants: A Systematic Review and Meta-analysis', *World Journal of Dentistry*, pp. 496–502. doi: 10.5005/jp-journals-10015-1493.
- [23] Griggs, J. A. (2007) 'Recent Advances in Materials for All-Ceramic Restorations', *Dental Clinics of North America*, pp. 713–727. doi: 10.1016/j.cden.2007.04.006.
- [24] Håff, A. et al. (2015) 'A retrospective evaluation of zirconia-fixed partial dentures in general practices: An up to 13-year study', *Dental Materials*, pp. 162–170. doi: 10.1016/j.dental.2014.11.009.
- [25] Hobo, S. and Shillingburg, H. T. (1973) 'Porcelain fused to metal: Tooth preparation and coping design', *The Journal of Prosthetic Dentistry*, pp. 28–36. doi: 10.1016/0022-3913(73)90075-9.

- [26] Homaei, E. et al. (2016) 'Static and fatigue mechanical behavior of three dental CAD/CAM ceramics', *Journal of the Mechanical Behavior of Biomedical Materials*, pp. 304–313. doi: 10.1016/j.jmbbm.2016.01.023.
- [27] Jain, A., Ranganathan, H. and Ganapathy, D. (2017) 'Cervical and incisal marginal discrepancy in ceramic laminate veneering materials: A SEM analysis', *Contemporary Clinical Dentistry*, p. 272. doi: 10.4103/ccd.ccd_156_17.
- [28] Jyothi, S. et al. (2017) 'Periodontal Health Status of Three Different Groups Wearing Temporary Partial Denture', *Research Journal of Pharmacy and Technology*, p. 4339. doi: 10.5958/0974-360x.2017.00795.8.
- [29] Kanat, B. et al. (2014) 'Effect of Various Veneering Techniques on Mechanical Strength of Computer-Controlled Zirconia Framework Designs', *Journal of Prosthodontics*, pp. 445–455. doi: 10.1111/jopr.12130.
- [30] Kannan, A. and Venugopalan, S. (2018) 'A systematic review on the effect of use of impregnated retraction cords on gingiva', *Research Journal of Pharmacy and Technology*, p. 2121. doi: 10.5958/0974-360x.2018.00393.1.
- [31] Kitaoka, A. et al. (2018) 'Clinical Evaluation of Monolithic Zirconia Crowns: A Short-Term Pilot Report', *The International journal of prosthodontics*, 31(2), pp. 124–126.
- [32] Komine, F., Blatz, M. B. and Matsumura, H. (2010) 'Current status of zirconia-based fixed restorations', *Journal of Oral Science*, pp. 531–539. doi: 10.2334/josnusd.52.531.
- [33] Lekesiz, H. (2014) 'Reliability Estimation for Single-unit Ceramic Crown Restorations', *Journal of Dental Research*, pp. 923–928. doi: 10.1177/0022034514544215.
- [34] Lopez-Suarez, C. et al. (2016) 'Marginal Vertical Discrepancies of Monolithic and Veneered Zirconia and Metal-Ceramic Three-Unit Posterior Fixed Dental Prostheses', *The International Journal of Prosthodontics*, pp. 256–258. doi: 10.11607/ijp.4541.
- [35] Mitov, G. et al. (2016) 'Influence of the preparation design and artificial aging on the fracture resistance of monolithic zirconia crowns', *The Journal of Advanced Prosthodontics*, p. 30. doi: 10.4047/jap.2016.8.1.30.
- [36] Miura, S. et al. (2018) 'Clinical evaluation of zirconia-based all-ceramic single crowns: an up to 12-year retrospective cohort study', *Clinical Oral Investigations*, pp. 697–706. doi: 10.1007/s00784-017-2142-y.
- [37] Naenni, N. et al. (2015) 'A randomized controlled clinical trial of 3-unit posterior zirconia–ceramic fixed dental prostheses (FDP) with layered or pressed veneering ceramics: 3-year results', *Journal of Dentistry*, pp. 1365–1370. doi: 10.1016/j.jdent.2015.07.013.
- [38] Napankangas, R., Salonen, M. A. M. and Raustia, A. M. (1997) 'A 10-year follow-up study of fixed metal ceramic prosthodontics', *Journal of Oral Rehabilitation*, pp. 713–717. doi: 10.1046/j.1365-2842.1997.00554.x.
- [39] Peláez, J. et al. (2012) 'A prospective evaluation of zirconia posterior fixed dental prostheses: Three-year clinical results', *The Journal of Prosthetic Dentistry*, pp. 373–379. doi: 10.1016/s0022-3913(12)60094-8.
- [40] Quinn, J. B., Sundar, V. and Lloyd, I. K. (2003) 'Influence of microstructure and chemistry on the fracture toughness of dental ceramics', *Dental Materials*, pp. 603–611. doi: 10.1016/s0109-5641(03)00002-2.
- [41] Raigrodski, A. J. et al. (2012) 'Survival and complications of zirconia-based fixed dental prostheses: A systematic review', *The Journal of Prosthetic Dentistry*, pp. 170–177. doi: 10.1016/s0022-3913(12)60051-1.
- [42] Rodríguez, V. et al. (2016) 'Fracture Load Before and After Veneering Zirconia Posterior Fixed Dental Prostheses', *Journal of Prosthodontics*, pp. 550–556. doi: 10.1111/jopr.12357.
- [43] Sailer, I. et al. (2016) 'Corrigendum to "All-ceramic or metal-ceramic tooth- supported fixed dental prostheses (FDPs)? A systematic review of the survival and complication rates. Part I: Single crowns (SCs)" [Dental Materials 31 (6) (2015) 603-623]', *Dental materials: official publication of the Academy of Dental Materials*, 32(12), pp. e389–e390.

- [44] Sailer, I. et al. (2017) ‘Comparison of Fixed Dental Prostheses with Zirconia and Metal Frameworks: Five-Year Results of a Randomized Controlled Clinical Trial’, *The International Journal of Prosthodontics*, pp. 426–428. doi: 10.11607/ijp.5183.
- [45] Schatz, C. et al. (2016) ‘Influence of Specimen Preparation and Test Methods on the Flexural Strength Results of Monolithic Zirconia Materials’, *Materials*, p. 180. doi: 10.3390/ma9030180.
- [46] Selvan, S. R. and Ganapathy, D. (2016) ‘Efficacy of fifth generation cephalosporins against methicillin-resistant *Staphylococcus aureus*-A review’, *Research Journal of Pharmacy and Technology*, p. 1815. doi: 10.5958/0974-360x.2016.00369.3.
- [47] Silva, N. R. F. A. et al. (2010) ‘Reliability of Metallo-ceramic and Zirconia-based Ceramic Crowns’, *Journal of Dental Research*, pp. 1051–1056. doi: 10.1177/0022034510375826.
- [48] Subasree, S., Murthykumar, K. and Dhanraj (2016) ‘Effect of Aloe Vera in Oral Health-A Review’, *Research Journal of Pharmacy and Technology*, p. 609. doi: 10.5958/0974-360x.2016.00116.5.
- [49] Sun, T. et al. (2014) ‘Load-bearing capacity and the recommended thickness of dental monolithic zirconia single crowns’, *Journal of the Mechanical Behavior of Biomedical Materials*, pp. 93–101. doi: 10.1016/j.jmbbm.2014.03.014.
- [50] Thompson, G. A. (2016) ‘WITHDRAWN: Comments regarding: Janyavula S, Lawson N, Cakir D, Beck P, Ramp LC, Burgess JO. The wear of polished and glazed zirconia against enamel. *J Prosthet Dent* 2013;109:22-9’, *The Journal of Prosthetic Dentistry*. doi: 10.1016/j.prosdent.2016.04.026.
- [51] Venugopalan, S. et al. (2014) ‘Magnetically retained silicone facial prosthesis’, *Nigerian journal of clinical practice*, 17(2), pp. 260–264.
- [52] Vijayalakshmi, B. and Ganapathy, D. (2016) ‘Medical management of cellulitis’, *Research Journal of Pharmacy and Technology*, p. 2067. doi: 10.5958/0974-360x.2016.00422.4.
- [53] Zarone, F., Russo, S. and Sorrentino, R. (2011) ‘From porcelain-fused-to-metal to zirconia: clinical and experimental considerations’, *Dental materials: official publication of the Academy of Dental Materials*, 27(1), pp. 83–96.

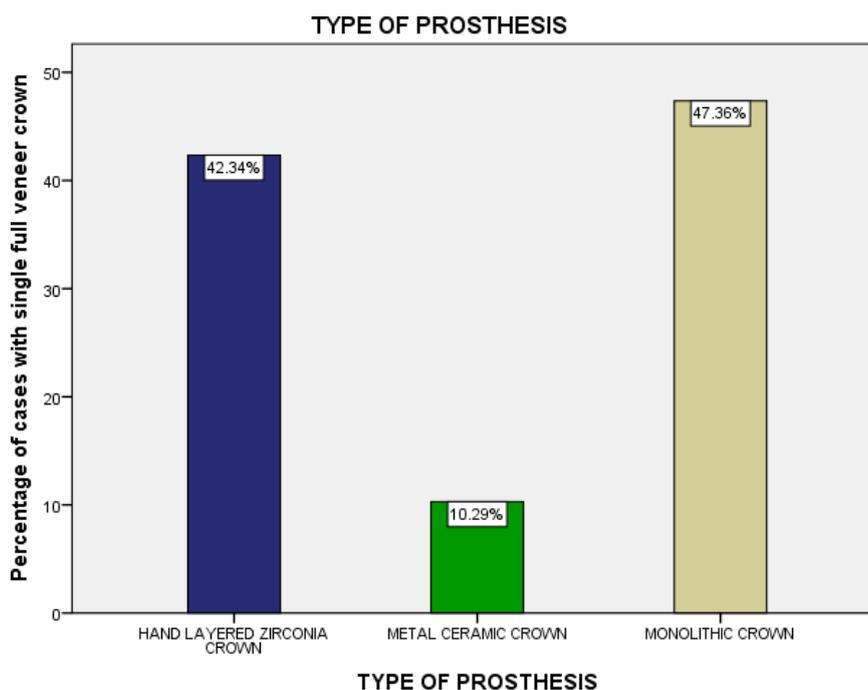


Figure 1: Bar graph depicting the prevalence of different types of crown .X axis represents the type of crown and Y axis represents the percentage , there is more prevalence of monolithic crown (47.36%) in comparison to hand layered zirconia(42.34%), and metal ceramic crown(10.29%).

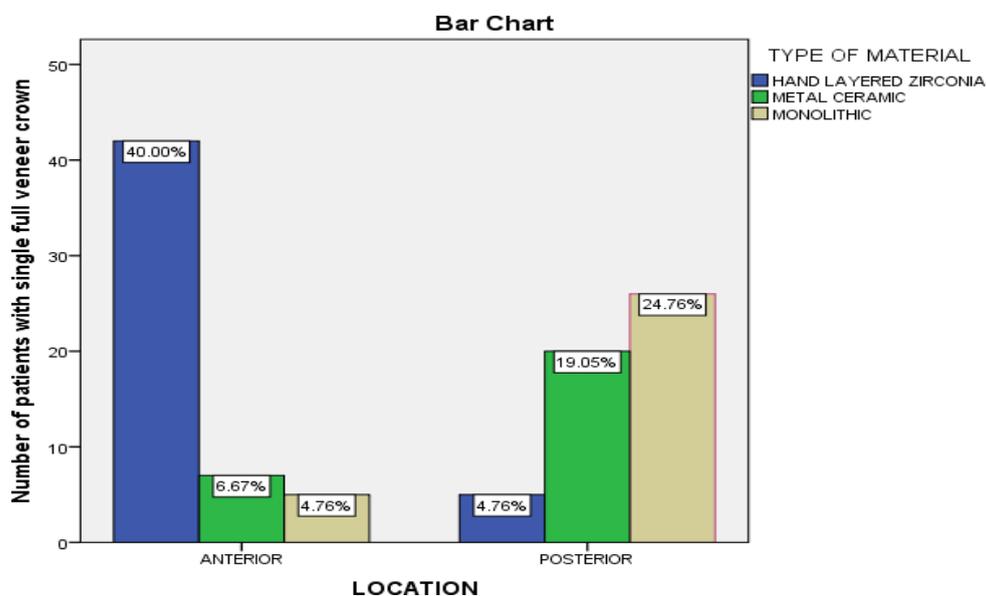


Figure 2: Bar graph depicting the association between different types of crowns and different locations (anterior/posterior),X axis represents location(anterior/ posterior) and Y Axis represents number of patients with single full veneer crown.Pearson Chi Square value=49.5, p value=0.001(p<0.05, statistical significant). Therefore hand layered zirconia crowns (blue) are mostly preferred for anterior restorations whereas monolithic zirconia(beige) and metal ceramic(green) are preferred for posterior restorations and the difference was statistically significant .

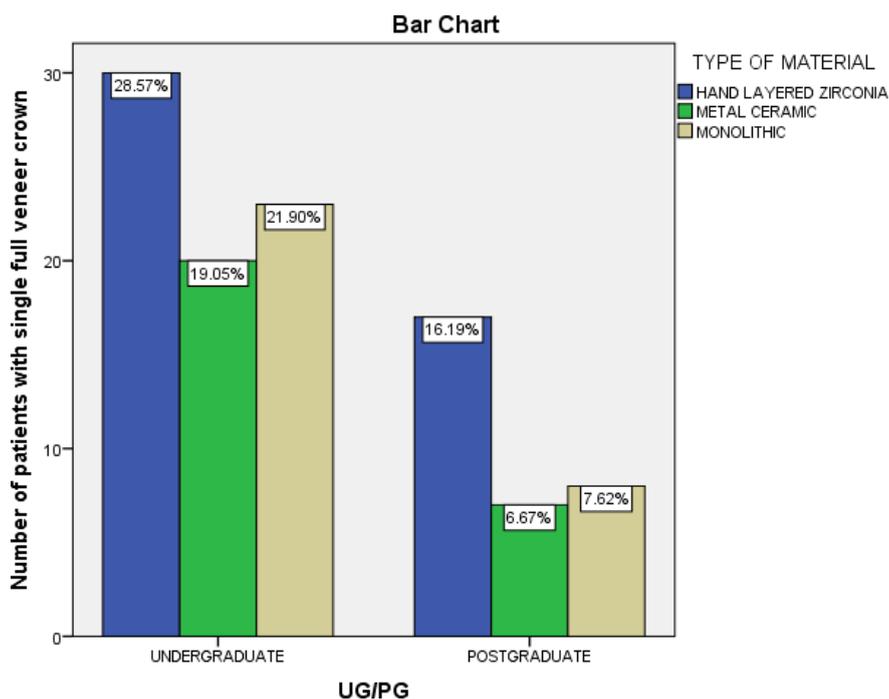


Figure 3: Bar graph depicting the association between different types of crowns and choice made by undergraduate/postgraduate ,X axis represents undergraduates and postgraduates students and Y Axis represents number of patients with single full veneer crown.Pearson Chi Square value =1.30, p value=0.522 ($p>0.05$). Both undergraduates and postgraduates preferred hand layered zirconia(blue) compared to monolithic(beige), metal ceramic(green) and the difference was not statistically significant.

		TYPE OF MATERIAL			Total	PEARSON CHI-SQUARE STATISTICAL VALUES
		HAND LAYERED ZIRCONIA	METAL CERAMIC	MONOLITHIC		
LOCATION	ANTERIOR	42	7	5	54	Value =49.5 P value= 0.001*
	POSTERIOR	5	20	26	51	
Total		47	27	31	105	

UG/PG	UNDERGRADUATE	30	20	23	73	value=1.30 P value=0.522**
	POSTGRADUATE	17	7	8	32	
Total		47	27	31	105	

Table 1: This table represents association between different types of crowns and different locations (anterior/posterior), *P value < 0.05 statistically significant; ** P value > 0.05 statistically not significant.