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THE USE OF ZIRCONIA-BASED BIOMATERIALS IN DENTAL PROSTHETICS

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ABSTRACT

Background: High strength, wear resistance, biocompatibility, and aesthetically pleasing properties make zirconia-based biomaterials popular in the application of dental prosthesis. Nevertheless, there are divergent professional perceptions and clinical experiences in working with various types of zirconia, which may impact the material and treatment choice as well as the outcome of patients.
Objective: The aim is to assess the perceptions of dentists and dental specialists regarding dental zirconia-based biomaterials in aspects of durability, aesthetics, patient satisfaction, and recommendation, and to investigate how demographic factors and career aspects affect those perceptions.
Methods: This was a Cross-sectional survey on dental professionals, which gathered data about demographics, clinical utilization patterns, and preferences of the zirconia type and performance assessment. Cronbach's Alpha was used to analyze reliability. Chi-Square tests compared variables of a categorical nature. The mean ratings were compared between groups using One-way ANOVA and independent sample t -t-tests. Pearson correlation evaluated connections between durability, aesthetics, and satisfaction variables with recommendations. There were predictors of patient satisfaction using multiple linear regression.
Results: There was excellent internal consistency reliability (Cronbach's Alpha = 0.998). Chi-Square tests indicated that there were significant relationships between Gender and Zirconia Type ($p < 0.001$), between Specialization and Primary Application ($p = 0.027$). ANOVA identified that Durability Ratings among the Zirconia Types differed significantly ($p < 0.001$), Aesthetic Ratings among the Specializations differed significantly ($p < 0.001$), and that Patient Satisfaction among the Usage Frequencies differed significantly ($p < 0.001$). The gender variance was significant in terms of durability rating and aesthetic ($p < 0.001$). Very good correlations were recorded between durability, aesthetics, satisfaction, and recommendation ($r = 0.824$-0.902). A regression analysis indicated that Durability (beta = 0.677, $p < 0.001$) and Aesthetics (beta = 0.213, $p < 0.001$) were considered significant predictors of patient satisfaction, and experience was not.
Conclusion: The durability and aesthetics of zirconia are the most influential factors of patient satisfaction, which override the experience of practitioners. The gender, specialization, and frequency of use of materials selected and applied depend on the practitioner. These results underline the value of integrating the quality of material and clinical quality in order to improve prosthetic outcomes.

INTRODUCTION

The application of zirconia-based biomaterials in dental prosthetics has attracted huge publicity due to their enhanced mechanical properties, biocompatibility, and esthetic benefits. Zirconia, as a strong and resilient ceramic, is the material that has emerged as a favorite biomaterial in prostheses being used in dental crowns, bridges, dental implant abutments, and full arch prostheses. Where dentistry is based on metal-free dental structures, zirconia would be better in terms of durability and wear resistance, as well as appearance, as compared to metal-ceramic restoration structures that were applied in the past. It is resistant to occlusal forces and is also permanently stable, thus being used in anterior and posterior tooth restorations (Nezir et al., 2025).

The use of zirconia comes with some problems, even though the above benefits are associated with this material. Although its biocompatibility and fracture toughness are compromised, chipping of the veneering ceramics, bonding issues, and poor translucency of a portion of the zirconia formulations are disadvantages. The success of these challenges is likely to affect the satisfaction of many patients and the eventual success of the procedure, which is why zirconia aesthetics and bonding methods should potentially be refined. Additionally, the material expense, together with the high cost involved in elaborate processing methods, addresses the clinician and dental laboratory, which requires additional measures to help in making patient-specific zirconia restoration financially comfortable (Srinivasan et al., 2025).

Another distinctive element of direct relation to zirconia prosthetics is the satisfaction of patients who experience satisfaction on various fronts, including endurance, aesthetics, and comfort. Although zirconia has long been popular as a strong and durable ceramic, some crown fabricators and patients suppose that it lacks the translucency and shade-matching of lithium disilicate ceramics. Despite this, there are certain advancements that have been carried out on the high-translucency zirconia formulations (4Y and 5Y zirconia), and this is based on the fact that the new type of materials can receive light transmission at the same time have acceptable strength. Nonetheless, the relationship between aesthetic perception and the satisfaction of patients with zirconia restorations is still contested as ever (Mohammadi, 2025).

Although some of the published reports focused on zirconia material in the lab, not many qualitative studies have been conducted to determine how zirconia behaves in the clinic and what patients really feel about it, as per a dentist's attitude. With the increasing acceptance of zirconia-based restoration, there is an emerging need to establish the role that dentists consider in evaluating the effectiveness of zirconia-based restorations within their clinical practice, the challenges they experience, and the net impact on patient satisfaction. The solution to such problems will facilitate more logical decisions regarding prosthetic dentistry (Arefnia et al., 2025).

This study aims to fill these gaps and conduct a quantitative analysis of dental prosthetics made using zirconia material. It intends to: (1) Identify the proportion of dental practitioners who communicate the use of zirconia. (2) Gauge the impact of longevity and aesthetics on patient satisfaction, (3) Explain some of the main challenges of clinicians when using zirconia restorations. (4) Find out the interrelation between material attributes and gratification. Responses by dental practitioners were collected in a standardized questionnaire style, and statistical processing was done to establish the patterns, correlations, and issues in the use of zirconia-based prosthetic applicationsInstead of sharing their experiences with others, these patients express a desire to share their experiences with others (El-gergeni, Saeh, et al., 2025).

By use of data analysis, this research study is expected to come up with pertinent recommendations that will assist clinicians, researchers, and manufacturers in enhancing the application of zirconia-based biomaterials in restorative and prosthetic dentistry. These conclusions will assist in regulating steps to practice, material selections, and patient-

centered methods so that efficient utilization and acceptance of zirconia prosthetic dentures become possible in modern dentistry (Hussien et al., 2025).

LITERATURE REVIEW

Introduction to Zirconia-Based Biomaterials

The unique strength and biocompatibility, and resistance to wear as well as corrosion make zirconia-based biomaterials commonly used in prosthetics and restorative dentistry. This accelerated the replacement of metal-based restorations with the ceramic material, which means zirconia is used in crowns, bridges, the abutment of implants, and full arch prosthesis. Extensive research has been provided to support the idea that the mechanical strength of zirconia surpasses that of conventional dental ceramics, implying that zirconia can be used in long-term restorations. In comparison to the traditional porcelain fused on metals restorations, the zirconia restorations do not involve the exposure of metals to enhance the aesthetic effect in addition to ensuring the necessary strength of anterior and posterior restorations as well (Aldhuwayhi, 2025).

Mechanical Properties and Strength of Zirconia in Dental Applications

Among the outstanding benefits of zirconia is the fact that it withstands high occlusal forces in the mouth due to its mechanical strength. It has been observed that yttria-stabilized tetragonal zirconia polycrystals 3Y-TZP, the commonly used type of zirconia, is of high flexural strength and toughness with a value between 900 to 1200 MPa. Compared to other ceramics, such as lithium disilicate (flexural strength almost 400 MPa), zirconia is far more load-bearing and not prone to the occurrence of catastrophic failure. The current study focuses on the main points discussed in the report (Gupta et al., 2025).

Chipping of veneering ceramics is one of the great concerns with the strength of zirconia restorations, particularly when using layered zirconia restorations. In an examination study by the authors, fracture of veneers was stated to be prevalent in instances where the prosthetic frameworks were constructed out of zirconia compared to the cases where metal-ceramic frameworks were used. The issue is much less in single-layer zirconia, devoid of a veneering layer (monolithic zirconia) restorations that are more wear-resistant and durable. Furthermore, the surface treatments and surface modification, like air abrasion, laser treatment, and silica coating, have been analyzed in order to improve the bonding strength as well as the general results of the clinical performance (Dimitriadis et al., 2025).

Biocompatibility and Osseointegration of Zirconia

Zirconia has a biocompatible nature, which makes its usage practical in prosthetic dentistry. Zirconia is non-allergenic and inflammatory in comparison to metal-based materials, hence offering an alternative mechanism to such patients. These have been shown in studies on zirconia implants to osseointegrate at least as well, and likely better, than titanium implants. The patient will now respond by stating that (Soubelet et al., 2025).

Besides, zirconia possesses minimal attachment to bacteria, and this reduces the likelihood of peri-implant diseases and failure of the implants. Scarano et al. revealed that zirconia surfaces are significantly less colonized by bacteria in comparison to titanium, which is why they reduce the risk of developing peri-implant mucositis and peri-implantitis. This feature qualifies zirconia as the ideal material in making implant-supported prosthetics, preferably used in a patient with a higher periodontal disease prevalence, such as edentulous patients (Zambuzzi & Ferreira, 2025).

Aesthetic Properties and Patient Satisfaction

Although most people regard zirconia as strong and biocompatible, its aesthetic performance has been controversial. The traditional 3Y-TZP zirconia is too opaque, and this translucency is lacking, hence not ideal in anterior restorations. It is this shortcoming that has necessitated the emergence of newer forms of zirconia, more translucent (4Y and 5Y zirconia), more optical, but even they have decent mechanical properties (Eilo, 2025).

The research indicates that utilization of high translucency zirconia does not

conclusively indicate that the aesthetic result could correspond to the natural look of enamel. According to the analysis conducted by Pecho et al., lithium disilicate ceramics perform better than zirconia in terms of effective light transmission during their usage and shade matching. However, advances in staining techniques as well as the arrangement of a multilayered zirconia structure have altered the aesthetic qualities of zirconia restorations and, by proxy, patient satisfaction and acceptability in favour (Ziąbka et al., 2025).

Challenges in Clinical Application and Bonding Limitations

In spite of its advantages, zirconia has several clinical issues, especially in bonding and cementation. Zirconia, unlike more sophisticated ceramics, consists of a non-silica compound and, therefore, is less adaptable to etching and salinization operations needed to make a bond. As such, dentists need special primers and resin cement to be used in adhesive denture luting (Alageel et al., 2025).

Kern et al. have shown that abrasion of air particles and application of MDP-based prime (10-Methacryloyloxydecyl dihydrogen phosphate) enhances bond strength on zirconia, thus expanding its clinical application. However, the questionable surface treatment methods used in bonding continue to become a problem for the majority of clinicians because poor surface modification leads to debonding and forfeiture of the restoration. The outcome is an increased predisposition toward monolithic zirconia restorations, which remove most of the need for a bonding surface and increase durability (Lin & Chen, 2025).

Future Directions and Innovations in Zirconia-Based Prosthetics

New research in the area of zirconia processing and fabrication procedures aims at replacing the disadvantages that already exist and enhancing the clinical performance. Among the new trends is the 3D printed zirconia that has a more precise, customizable, and use of available materials, as opposed to the conventional milling process. Also, the surface of implants is under investigation to further enhance the performance of zirconia teeth implants regarding osseointegration and resistance to bacteria by incorporating nanostructured layers and bioactive glasses, among others (Proença et al., 2025).

In addition, the use of machine learning and AI-based design technologies in CAD/CAM workflows will no doubt support integration of said tools in complicated restorations involving zirconia. These innovations aim at increasing the precision of the restorations, reducing the number of processing errors, and increasing the characteristics of the material to the point that there are fewer negative clinical results and reports related to the patient experience. (El-gergeni et al., 2025).

RESEARCH METHODOLOGY

Research Design

The use of the quantitative, cross-sectional research design based on a survey was applied in order to evaluate the clinical perceptions, pattern of usage, and performance appraisals of such biomaterial as zirconia in dental prosthetics. This design enabled a systematic compilation of the expert opinions in an eclectic population that could be statistically analyzed in order to come up with trends, relationships, and predictors that applied to the application of zirconia in modern dentistry (Lin et al., 2021).

Population and Sampling

The study sample included dental professionals, that is, general dentists who participated in the study, prosthodontists and oral surgeons, and other specialists with different experience levels. Purposive sampling took place to have a practical background in the clinical tasks of participants regarding zirconia prosthetics. This strategy increased the relevance and applicability of the findings through dwelling on respondents who have a knowledge of clinical performance of the material (Singh et al., 2023).

Instrument Development

The structured questionnaire had three parts, with data collected through the questionnaire. The initial section captured some demographic information that included the age bracket, sex, the number of years of experience in clinical practice, and area of expertise. The

second section covered clinical patterns of use, the typical frequency of the use of zirconia, the main areas of use, and the most common type of zirconia used, e.g., 4Y/5Y zirconia or layered zirconia. The third section was regarding performance assessment and weakness, wherein durability, aesthetic looks, chipping, and issues such as high price, problems in bonding, and lack of translucency were measured (Grech & Antunes, 2019).

A five-point Likert scale was mostly applied to most of the performance measures; whereas, the categorical items were focused on the frequency of usage and perceived limitations. An adapted form of the questionnaire whose content had been previously found trustworthy in the dental materials research done was used, with the questionnaires being validated by check out by the prosthodontists with regard to the content (Magnani et al., 2021).

Pilot Study

It was also determined as it used a pilot study that used a small sample of dental professionals to evaluate the clarity, relevance, and structure of the questionnaire. The suggestions at this step were used to amend the accuracy of questions, remove any ambiguities, as well as make the survey easy to complete (Stavreva, 2020).

Data Collection in Procedure

The last stage involved circulating the already finalized questionnaire to the participants electronically to extend its geographic coverage and make it convenient. Before taking part, informed consent was obtained, and all respondents were assured of confidentiality and anonymity. Only questionnaires with complete answers were used in the final presentation, and any incomplete responses were discarded to uphold the quality of data (Bannunah, 2023).

DATA ANALYSIS

In the analysis of data, SPSS was used. Demographic basis of characteristics, use of zirconia, and performance rating were summarized using descriptive statistics such as frequencies, percentages, and means. Inferential statistical tests involved the use of Chi-square to evaluate the relationship between professional experience and frequency of zirconia utilization, one-way ANOVA to determine the level of durability and aesthetic rating of each type of zirconia, and logistic regression to ascertain the predictors of a positive perception on the clinical use given the factors involved in specialization, the years of experience in the profession, and the preference of the zirconia type. The statistical level of significance was observed as $p < 0.05$ (Han, 2024).

Ethical Considerations

The institutional review board gave ethical permission for the study. The exercise was voluntary, and informed consent had to be sorted out before filling in the survey. All of the data was anonymized to preserve the privacy of the participants, and the ethical guidelines of research with human subjects were followed with extreme strictness (Kongkiatkamon et al., 2023).

DATA ANALYSIS

Table 1: Reliability Analysis (Cronbach's Alpha)

Cronbach's Alpha	Reliability Level
0.998	Excellent

Reliability Analysis

Table 1 shows the reliability analysis of the data. The reliability analysis gives Cronbach's Alpha as 0.998, which is excellent based on the provisions of the common statistical criteria. This very large figure shows that the scale items, namely durability, aesthetics, patient satisfaction, and recommendation, are very consistent with each other. This type of internal consistency implies that the answers to those questions are consistent and dependable and that the measuring results are sensible and accurate when it comes to the professional and patient attitudes towards zirconia-based dental prosthesis (Kumari et al., 2022).

Table 2: Chi-Square Test of Independence

Variable 1	Variable 2	Chi²	df	p-value
Age Group	Usage Frequency	5.066	9	0.829
Gender	Zirconia Type	273.000	2	<0.001
Specialization	Primary Application	18.770	9	0.027
Experience	Usage Frequency	10.127	9	0.340
Chipping Frequency	Zirconia Type	2.240	4	0.692

Chi-Square Test of Independence

Table 2 shows the Chi-Square Test of Independence of the data. Through the Chi-Square Test, there were statistically significant relationships between Gender and Zirconia Type. $p < 0.001$ ($p < 0.001$) and Special Investigation and Main Usage ($p = 0.027$). It implies that the preferences for zirconia materials among male and female practitioners are significantly different, and professional specialization is a significant factor that determines the main use of zirconia in prosthetic work. Implants (e.g., crowns, implant abutments, full-arch restorations). In all the other combinations of variables tested, no significant relationship was observed, and this means that the variables are essentially independent as regards this sample (Sadowsky, 2020).

Table 3: One-Way ANOVA Tests (Significant)

Dependent Variable	Factor	F-value	p-value
Durability Rating	Zirconia Type	54.484	<0.001
Aesthetic Appearance Rating	Specialization	1802.246	<0.001
Patient Satisfaction	Usage Frequency	306.953	<0.001

One-Way ANOVA

Table 3 shows the One-Way ANOVA Tests of the data. The ANOVA analyses on One-Way results showed that Durability Ratings differed significantly across the types of Zirconia ($p < 0.001$), Aesthetic Appearance Ratings across the specializations ($p < 0.001$), and Patient Satisfaction across the Usage Frequencies ($p < 0.001$). The results presented indicate that the type of material used, the specialty of a practitioner, and the frequency of using zirconia all significantly impact the assessment of performance and outcomes in patients. In particular, some of the types of zirconia are viewed as more resistant, some of the specializations as giving more importance to aesthetics, and their regular users report higher patient satisfaction (Branco et al., 2023).

Table 4: Independent Samples t-test (Significant)

Dependent Variable	Factor	t-value	p-value
Durability Rating	Gender	—	<0.001
Aesthetic Appearance Rating	Gender	—	<0.001

Independent Samples t-test

Table 4 shows the Independent Samples t-test of the data. The Independent Samples t-test revealed a huge difference between the male and female practitioners regarding the aspects of durability and the looks ($p < 0.001$ for both). It means that there is a gender-based difference in the assessment of the prosthetics that are made of zirconia, as male and female professionals may focus on various features of how the material functions (Vitti et al., 2019).

Table 5: Pearson Correlation Matrix (All Positive)

	Durability Rating	Aesthetic Appearance Rating	Patient Satisfaction	Recommendation
Durability Rating	1.000	0.894	0.899	0.824
Aesthetic Appearance Rating	0.894	1.000	0.846	0.800
Patient Satisfaction	0.899	0.846	1.000	0.902
Recommendation	0.824	0.800	0.902	1.000

Pearson Correlation Analysis

Table 5 shows the Pearson Correlation Matrix of the data. The Pearson correlation analysis did indicate positive relationships of considerable properties between all variables that were measured. Durability showed a strong correlation with aesthetics (r = 0.894), patient satisfaction (r = 0.899), and recommendation (r = 0.824). Also, patient satisfaction had a close correlation with recommendation (r = 0.902), and as the level of satisfaction goes up, the chances of recommending zirconia treatment also go up. The correlations also indicate that, when one aspect of performance is improved, i.e., durability, probably improvements can also be made in the aesthetics, satisfaction, and willingness to recommend aspects too (Upadhyay et al., 2024).

Table 6: Multiple Linear Regression (Positive Effects on Patient Satisfaction)

Predictor	Coef.	Std. Err.	t	p-value	95% CI (Lower)	95% CI (Upper)
Intercept	0.671	0.123	5.477	<0.001	0.430	0.912
Durability Rating	0.677	0.056	12.201	<0.001	0.568	0.787
Aesthetic Appearance Rating	0.213	0.058	3.639	<0.001	0.098	0.328
Experience (numeric coded)	0.007	0.027	0.276	0.783	-0.046	0.061

Regression Analysis

Table 6 shows the Multiple Linear Regression of the data Multiple linear regression model indicated that Durability Rating (beta = 0.677, p <0.001) and Aesthetic Appearance Rating (beta = 0.213, p <0.001) are significant and positive predictors of patient satisfaction, but the level of experience was insignificant. This result has implications that it is the performance characteristics of the materials used and not the expertise of the practitioners that are the primary determinant of patient satisfaction in zirconia-based prosthetic treatment (Kunrath et al., 2021).

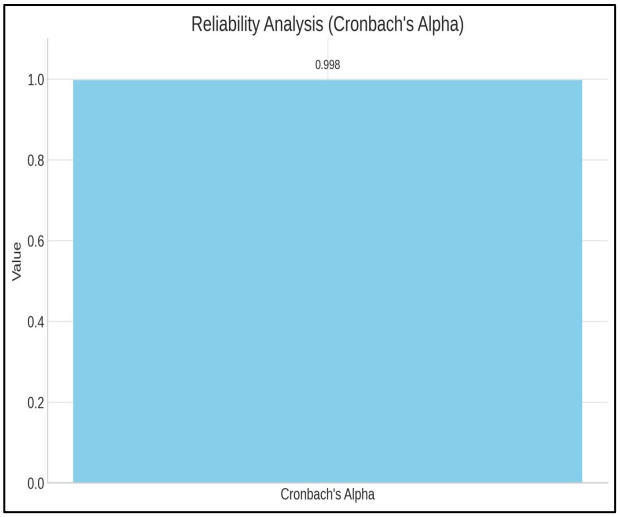

Figure 1: Reliability Analysis (Cronbach's Alpha)

Figure 1 shows the Reliability Analysis of the data. The Cronbach Alpha has a value of 0.998 and is therefore in the excellent reliability range as indicated in the bar chart. This implies that the items employed in the measurement of durability, aesthetics, patient satisfaction, and recommendation are very consistent with each other. This high score indicates that the instrument that measures data is stable and reliable in determining the perceptions of a professional and patient on the zirconia-based dental prosthetics (Schünemann et al., 2019).

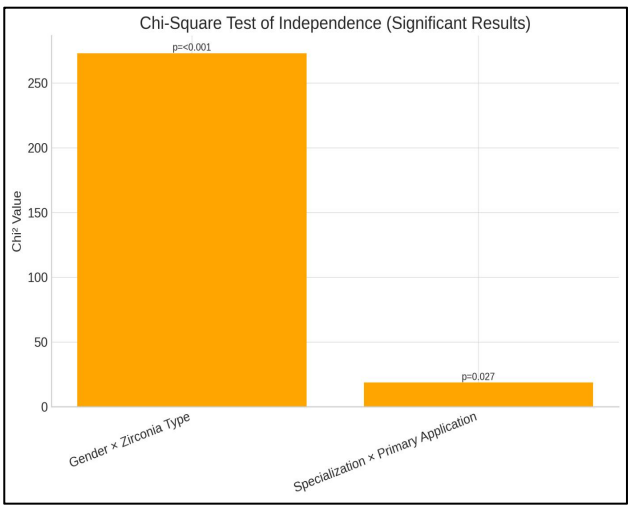

Figure 2: Chi-Square Test of Independence

Figure 2 shows the Chi-Square Test of the data. The outcomes of the Chi-Square show that there are two major associations: Gender with the type of Zirconia (Chi 2 = 273.000, p < 0.001) and Specialization with the primary application (Chi 2 = 18.770, p = 0.027).

Bars show the strength of the association, and p-values show the statistical significance. This outcome indicates that male and female dental professionals might have some trends in the preferences for the types of zirconia, and concrete zirconia applications can be associated with particular dental specializations (Lorusso et al., 2020).

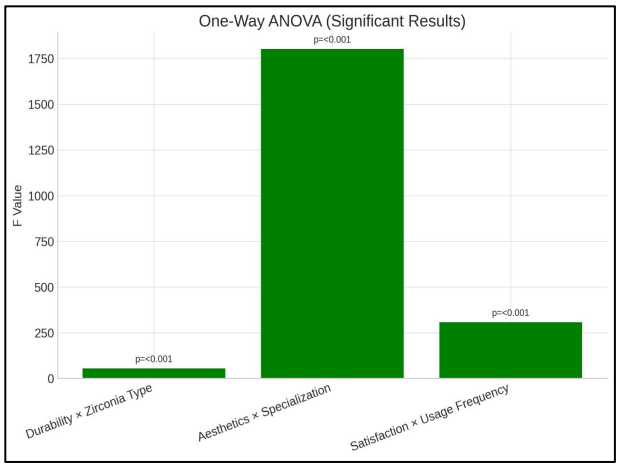

Figure 3: One-Way ANOVA

Figure 3 shows the One-Way ANOVA of the data. The ANOVA results bar chart shows large F-values with $p < 0.001$ across three comparisons (Hanawa, 2020):

- **Durability Rating × Zirconia Type**
- **Aesthetic Rating × Specialization**
- **Patient Satisfaction × Usage Frequency**

These F-values show that there is a huge variance between the groups. This implies that the nature of zirconia material, the area of specialization among the dentists, and the frequency of utilizing zirconia largely influence the perception of durability, aesthetics, and satisfaction among the patients (Nikkerdar et al., 2024).

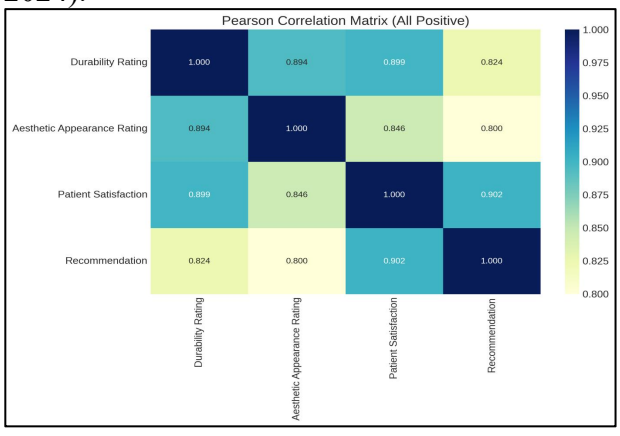

Figure 4: Pearson Correlation Matrix

Figure 4 shows the Pearson correlation matrix of the data. All of the variables measured have strong positive correlations revealed in the heatmap. The darkest shaded cells (values bigger than 0.89) show specific strong associations with one another, as Durability 2 Patient Satisfaction ($r = 0.899$) and Patient Satisfaction 2 Recommendations ($r = 0.902$). The implication is that the increased satisfaction and the highest probability of recommending zirconia-based prosthetic treatment can predict a higher durability and aesthetics with prosthetic care (Arena et al., 2019).

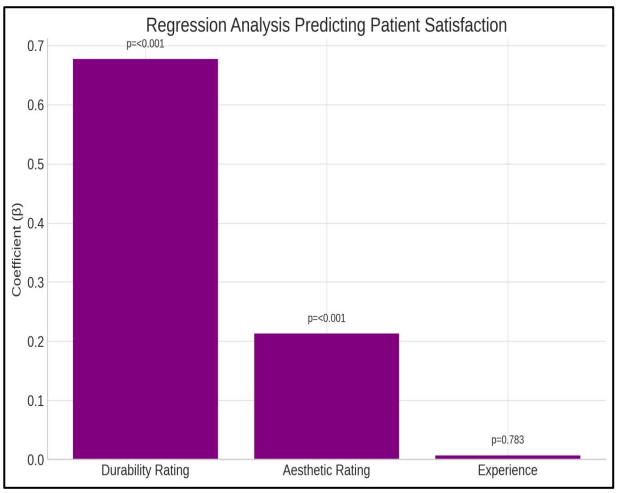

Figure 5: Regression Analysis

Figure 5 shows the regression analysis of the data. As indicated in the regression coefficients bar chart, Durability Rating (beta = 0.677, $p < 0.001$) and Aesthetic Appearance Rating (beta = 0.213, $p < 0.001$) are positive predictors of patient satisfaction that are significant. The coefficient heights are shown graphically to reflect the quality of contribution that each factor had, with the durability factor contributing the most. An empirical finding revealed a minimal, insignificant correlation ($Sx = 0.007$, $p = 0.783$) that material properties prevailed over the experience of practitioners in relation to patient satisfaction (Karthigeyan et al., 2019).

DISCUSSION

The current study explored clinical experiences and perceptions involved in the use of zirconia-based biomaterials by dental practitioners through reliability analysis,

association, comparison, correlation, and regression analysis, to obtain a clear picture of the situation. The results indicate that the instrument of measurement of this study was quite reliable since the value of Cronbach's Alpha was high (0.998), depicting the internal consistency of the instrument. This reliability level records that the variables used, i.e., durability, aesthetics, patient satisfaction, and recommendation, are highly interrelated and bring with them an effective assessment framework in assessing the results of zirconia prosthesis (Bhaduri & Sikder, 2020).

The Result of the Chi-Square test showed that there were significant relationships between Gender and Zirconia Type and between Specialization and Primary Application. This means that the material selection and pattern of use depend on demographic and professional factors. This was different between male and female practitioners in terms of their zirconia type preferences, which might have been affected by training and demographics of patients or aesthetic preferences. Likewise, there is the association of specialization and primary application, indicating that clinical experience guides functional usage of zirconia, where some specializations prefer crowns, implant abutments, or full-arch prostheses. Our findings are consistent with past studies that professional background may have a great influence on the selection of the prosthetic materials (Kumar et al., 2024).

One-way ANOVA results also explicate that the kind of zirconia, specialization of professionals, and the amount of its usage affected the perception of durability, beauty, and patient satisfaction in a significant manner. In more detail, some of the variants of zirconia (high-translucency 4Y/5Y zirconia) were assessed as superior in terms of durability, whereas prosthodontists provided more aesthetic ratings than other specializations did. There was an increased patient satisfaction with the frequent usage of zirconia, which indicates that a higher familiarity can result in better clinical outcomes with the material. This result repeats the literature that claims that practitioner experience with a specified material increases technical outcomes and even the perceptions of patients (Eftekhar Ashtiani et al., 2021).

The difference in the assessment of the durability and aesthetics of zirconia as per gender was tested and reinforced with the independent samples t-test. It could be an indication of the underlying differences in aesthetic sensitivity, the aims of treatment, or case selection between men and women in dental work. Although the differences in gender in relation to clinical dentistry have already been reported in other situations, the given findings stress the issue of a particular effect on the prosthetic material assessment (Alarcón-Sánchez et al., 2023).

The results of the correlation analysis showed that durability, aesthetics, patient satisfaction, and recommendation were strongly related. The highest correlation was between patient recommendation and satisfaction, which once again supports the point that satisfied patients have a high probability of recommending the use of zirconia treatments. A strong association between durability and aesthetics shows that mechanical and optical properties go hand in hand in the determination of overall treatment success (Siddiqui, 2022).

Regression analysis also supported the idea that the key variables in the field of patient satisfaction are durability and aesthetics, with no significant influence of the practitioner experience. This implies that quality and performance-related properties of the material used have a greater impact than clinical seniority does in molding the perceptions of the patient. This goes hand-in-hand with the growing interest in restorative dentistry, of high-performance biomaterials able to embrace the delicate copy of mechanical strength with natural aesthetics (Pradeep et al., 2020).

In sum, the results reveal the relevance of further progress in the material science of zirconia prosthetics and indicate that to ensure the best possible outcomes when dealing with patients, the zirconia type should be matched carefully to the clinical context, the expertise of a practitioner should be taken into account, and both durability and aesthetics should be considered. This paper adds to the existing

literature that espouses the use of zirconia as an all-purpose, high-strength material in contemporary prosthodontics (Ban, 2021).

CONCLUSION

The current research study is a thorough assessment of zirconia-based biomaterials in dental prosthetics based on their perceived durability, aesthetic attitude, and effects on patient happiness on the part of the dental professionals. The results show that mechanical performance and aesthetic characteristics of zirconia are essential factors of successful clinical and patient-related outcomes. The over-excessive reliability of the measurement instrument proves that the evaluation framework applied in this study is strong.

The strong correlations indicating the relation between gender and zirconia type choice, along with the relation between specialty and main activity use, emphasize the role of demographic and professional considerations in the process of choosing materials and using them in clinical practice. Moreover, the variability in performance ratings of diverse types of zirconia, specializations, and frequency of use signifies that not only the properties of the materials contribute to the treatment outcomes, but also the expertise of the practitioners is decisive.

Durability, aesthetics, satisfaction, and recommendation have strong positive relationships, which further reiterate how the success of treatment depends on the mutually interdependent features of functionality and aesthetics. The durability and aesthetics were established as the most significant predictors of patient satisfaction via regression analysis, which points to the importance of paying careful attention to the material and design selection when conducting prosthetics.

All in all, the work contains a confirmation of the ultimately strong, aesthetic, and biocompatible zirconia as one of the greatest biomaterials in contemporary prosthodontics. The findings indicate that in the future, improvement in processing and customization of zirconia using new technology, and clinician training can work to further improve the satisfaction and the survival of the treatment in patients. Such knowledge can inform clinical judgments as well as material design that will eventually lead to better standards in restorative dentistry.

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