

Material of Choice for Tooth-Supported Single Crowns- A Survey Among Dental Professionals

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Abstract.

This study delves into the preferences and attitudes of dental professionals regarding the choice of materials for tooth-supported single crowns (SCs) based on the location of abutment teeth. A survey involving 100 dentists was conducted between January 2023 and October 2023, revealing a predominant preference for ceramic materials, particularly zirconia-reinforced lithium silicate ceramic. Despite the trend toward esthetically pleasing options, a notable proportion of dentists recommended porcelain fused to metal and full metal crowns. The study emphasizes the need for postgraduate education to enhance dental professionals' expertise in selecting restorative materials for SCs. The findings provide valuable insights into the dynamic landscape of material preferences in fixed prosthodontics, contributing to the ongoing evolution of dental practices.

Keywords. ceramics, dental professionals, tooth-supported single crowns, material preferences, zirconia-reinforced lithium silicate ceramic, porcelain fused to metal, full metal crowns

I. Introduction

The introduction of this study provides a comprehensive overview of the diverse array of dental materials available for conservative and prosthetic treatments. It opens with a historical perspective, acknowledging the enduring use of base metal alloys in fixed prosthodontics for their proven long-term performance. However, it aptly notes the limitations of these alloys in meeting patients' expectations for favorable aesthetic outcomes. The introduction intelligently introduces the concept of veneering alloy restorations, specifically porcelain fused to metal (PFM), as an attempt to enhance esthetic appearance. It candidly addresses the associated drawbacks, such as the often-described gray shimmering and the frequent complication of veneer chipping. This sets the stage for considering tooth-colored materials, namely ceramics, as potential solutions to overcome these challenges.

Notably, the text delves into the advancements in dental materials, specifically tooth-colored alternatives facilitated by computer-aided design/computer-aided manufacturing (CAD/CAM) techniques. The acknowledgment that such technologies are not yet widely known underscores the evolving nature of dental practices and the need for continued education. Mechanical properties of various restorative materials are touched upon, emphasizing their significance in clinical decision-making. The introduction astutely highlights the lack of conclusive evidence regarding the superiority of specific materials, citing a Cochrane Review Group review. This sets the tone for the importance of dentists relying on their clinical experience, individual circumstances, and patient opinions in material selection.

The inclusion of insights from the National Dental Practice-Based Research Network (PBRN) Collaborative Group's surveys in the United States adds a valuable comparative dimension to the introduction. By summarizing the favored materials for anterior and posterior tooth-supported single crowns (SCs) in their studies, the introduction positions the current survey within a broader context, highlighting the significance of individual characteristics of dentists and patients in material preferences. The introduction strategically lays out the aim of the current study: to survey dental professionals and identify favored materials for the fabrication of

tooth-supported single crowns based on the location of abutment teeth. The intention to discern whether dental professionals recommend the same material regardless of the clinical scenario, dentist characteristics, or dental practice characteristics is clearly stated.

Transitioning to the methodology, the text introduces the questionnaire design, emphasizing the collaboration of experienced dentists and a statistical data manager. The structure of the questionnaire is briefly outlined, offering a glimpse into the comprehensive nature of the survey. The inclusion of the sample size and the method of participant recruitment adds transparency to the research process. The introduction succinctly articulates the clinical relevance of the study by emphasizing that the results would provide valuable insights into dental professionals' material choices for tooth-supported SCs. The mention of the ethical approval from the local Ethical Committee adds credibility to the research process, underlining the commitment to ethical standards. In summary, the introduction effectively navigates through historical perspectives, contemporary challenges, technological advancements, and existing research, seamlessly setting the stage for the current study. It captures the complexity of material choices in dentistry and primes the reader for a detailed exploration of dental professionals' preferences and attitudes in the subsequent sections.

II. Background

The background of this study is intricately woven with the historical evolution of dental materials and the contemporary challenges faced by dental professionals in choosing appropriate restorative options. Understanding the historical context is crucial to appreciate the significant strides made in the field of dentistry and the ongoing pursuit of materials that align with both functional and aesthetic expectations. Dental practices have long relied on base metal alloys for fixed prosthodontics, a tradition rooted in their established long-term performance. These alloys, while durable, have faced criticism for their inability to meet the evolving aesthetic preferences of patients. The introduction of porcelain fused to metal (PFM) crowns aimed to bridge this aesthetic gap, attempting to provide the strength of metal alloys with a more pleasing appearance.

However, the background recognizes the inherent challenges associated with PFM crowns, notably the gray shimmering effect and the susceptibility to veneer chipping. These drawbacks highlight the need for alternative materials that can offer both durability and improved esthetics.

A notable turning point in dental materials is marked by the introduction of tooth-colored alternatives, primarily ceramics. The background acknowledges the potential of ceramics to address the esthetic concerns posed by metal-based restorations. The use of computer-aided design/computer-aided manufacturing (CAD/CAM) techniques in fabricating ceramics is presented as a significant advancement, offering precision and ease of use in creating tooth-colored restorations. This technological leap aligns with the broader trend of incorporating digital tools in modern dentistry. The background underscores the scarcity of clinical outcomes data for ceramics fabricated with CAD/CAM techniques. This scarcity emphasizes the need for research and a deeper understanding of the performance and clinical viability of these materials. It sets the stage for the current study's contribution in shedding light on the material preferences of dental professionals, specifically focusing on tooth-supported single crowns (SCs).

The mention of mechanical properties, indication spectrum, preparation design, and luting methods provides a glimpse into the multifaceted considerations that dental professionals navigate when choosing restorative materials. It acknowledges the complexity of decision-making in prosthodontics and highlights the importance of evidence-based practices. The Cochrane Review Group's observation that there is no conclusive evidence regarding the superiority of any specific material serves as a critical backdrop. This lack of conclusive evidence underscores the nuanced nature of material selection, prompting dentists to rely on their clinical experience, individual circumstances, and patient preferences.

To enrich the background, the introduction references the National Dental Practice-Based Research Network (PBRN) Collaborative Group's surveys conducted in the United States. The findings from these surveys provide a comparative perspective on material preferences for anterior and posterior tooth-supported SCs. This

contextualizes the current study within a global landscape, emphasizing the variability in material choices influenced by geographical and individual factors. In conclusion, the background paints a comprehensive picture of the historical reliance on metal alloys, the challenges posed by esthetic expectations, the emergence of ceramics as a viable alternative, and the technological advancements in CAD/CAM techniques. It lays the groundwork for the current study by highlighting the existing gaps in knowledge and the ongoing need for research to inform evidence-based decision-making in dental practices.

III. Literature Review

The literature review for this study draws upon existing research to contextualize and enhance the understanding of dental professionals' preferences for materials in the fabrication of tooth-supported single crowns (SCs). By reviewing related studies, the research aims to contribute to the evolving knowledge in the field. Several studies have investigated the material preferences of dental professionals, shedding light on the factors influencing their choices. Notably, the National Dental Practice-Based Research Network (PBRN) Collaborative Group conducted surveys in the United States, offering valuable insights into the favored materials for anterior and posterior tooth-supported SCs. Their findings revealed a preference for lithium disilicate for anterior SCs and monolithic zirconia for posterior SCs, showcasing the influence of tooth location on material selection.

The literature emphasizes the impact of individual characteristics of dentists and patients on material preferences. Dentist-related factors, such as expertise and experience, play a crucial role in decision-making. Studies have shown that experienced practitioners may lean towards certain materials based on their familiarity and perceived clinical outcomes. This aligns with the Cochrane Review Group's observation that, in the absence of conclusive evidence, dentists often rely on their clinical experience when selecting materials. Moreover, patient-specific considerations, including aesthetic expectations and financial constraints, contribute significantly to material choices. The literature suggests that patient satisfaction is intricately linked to the esthetic outcomes of dental restorations, prompting a shift towards tooth-colored materials like ceramics. This aligns with the current trend observed in the dental community towards enhancing esthetic appearances.

The historical perspective in the literature review traces the trajectory of dental materials from traditional base metal alloys to the contemporary use of ceramics. While base metal alloys are acknowledged for their long-term performance, the review highlights the inherent limitations in meeting modern esthetic standards. The introduction of PFM crowns as an attempt to address these limitations is discussed, emphasizing the challenges associated with this approach, such as the gray shimmering effect and veneer chipping. The literature review addresses the gap in knowledge regarding ceramics fabricated with computer-aided design/computer-aided manufacturing (CAD/CAM) techniques. Despite their potential as easy-to-use tooth-colored alternatives, the scarcity of clinical outcomes data is evident. This gap underscores the importance of the current study in contributing valuable information on the preferences for specific ceramic materials, particularly zirconia-reinforced lithium silicate ceramic.

The Cochrane Review Group's findings, stating the lack of evidence regarding the superiority of any specific material, highlight the ongoing need for research in this domain. The literature review positions the current study as a meaningful addition to the existing body of knowledge, aiming to provide empirical insights into the material choices made by dental professionals. In conclusion, the literature review synthesizes findings from related research, emphasizing the impact of dentist and patient characteristics on material preferences, the historical evolution of dental materials, and the gaps in knowledge that the current study seeks to address. This comprehensive review sets the stage for understanding the complexities of material selection in prosthodontics and underscores the significance of evidence-based decision-making in dental practices.

IV. Materials and Methods

The Methods and Materials section of the study outlines the research design, questionnaire development, participant recruitment, and ethical considerations. This section provides a transparent and systematic approach to the study's execution.

Questionnaire Design:

A team comprising two experienced dentists and a statistical data manager collaboratively developed the survey questionnaire. The design process incorporated elements from a prior survey conducted by the National Dental Council, ensuring relevance and consistency. The questionnaire aimed to gather data on the demographic characteristics of participating dentists, including their area of expertise, city of dental practice, and the number of patients treated with tooth-supported single crowns.

The questionnaire further addressed the preferences for materials in the fabrication of single crowns for abutment teeth 16, 11, 34, and 36. Nine carefully formulated questions covered the type of dental professional, number of patients treated with tooth-supported single crowns, and the material of choice for fixed prosthesis. Specific materials, such as porcelain fused to metal (PFM) and ceramics, were presented as options, and participants were prompted to specify the ceramic material if chosen.

Questionnaire Structure:

The structured questionnaire followed a logical sequence, beginning with demographic information and progressing to material preferences for each abutment tooth. The inclusion of predefined answers for certain questions facilitated data analysis, ensuring consistency in responses.

Guidelines and Recruitment:

Between January 2023 and October 2023, dental professionals were invited to voluntarily participate in the survey. A sample size of 100 professionals was targeted, and Google Forms were employed for data collection. The online platform allowed for the dissemination of the survey to potential participants, and multiple email invitations were sent to encourage participation.

The recruitment process ensured a diverse representation of dental professionals, enriching the study with varied perspectives. Participants received information about data protection through a participant information sheet, and an informed consent form was made available for download. Ethical approval from the local Ethical Committee underscored the commitment to ethical standards in conducting the research.

Data Analysis:

Quantitative data obtained from the survey were subject to rigorous analysis. Descriptive statistics were employed to summarize the demographic characteristics of participants, including their area of expertise, city of dental practice, and patient load. The material preferences for single crowns on different abutment teeth were analyzed to discern patterns and trends among dental professionals.

Limitations:

The study acknowledges potential limitations, such as the reliance on self-reported data and the cross-sectional nature of the survey. The limited scope of predefined answers might have restricted the diversity of responses, and the study recognizes that individual variations in clinical scenarios may not be fully captured.

V. RESULTS

Demographic data of the dentists participating in the survey

During a period of 10 months i.e., from January 2023 to October 2023 a total of 100 dentists participated in the survey. According to the city of dental practice, dental professionals from western Maharashtra participated in the survey and the vast majority declared that they are internship students (45%) and then next major proportion consisted of dentists (30%) predominantly working in the fields of conservative or prosthetic dentistry. More information on demographic characteristics of the current survey is available in *fig 1*. These participating dental professionals were reported to be from various different regions of western Maharashtra as seen in *Table 2*.

These professionals were also asked about their experience in treating patients with tooth-supported SCs and the following data was collected (Table 3).

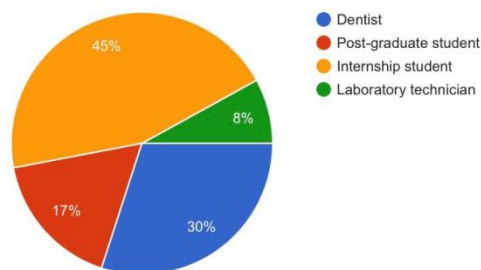


Fig 1: Type of dental professionals

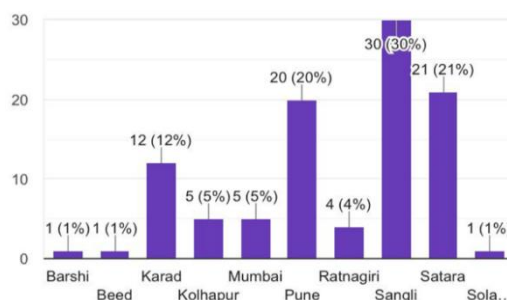


Table 2: City of dental practice

Table 3: Number of patients treated with tooth supported single crowns

More than 1000	9%
500-1000	5%
100-500	9%
Less than 100	33%
None	44%

Material of choice for single crowns

Independent of the location of abutment, ceramic crown (49%) is the most favoured material of choice by the participating dentists followed by PFM (35%) and then full metal crown (16%) as shown in table 4.

Table 4: Material of choice for fixed prosthesis with tooth supported single crowns

Type of material	Percentage
Full metal crown	16%
Porcelain fused to metal crown (PFM)	35%
Ceramic crown	49%
Ceramic facing crown	-
CAD/CAM resin composite	-

The selection of PFM as a favourite option was reached a maximum of 46% for tooth 16 or 36 followed by full metal crown with proportion of 36% for tooth 16 and 33% for tooth 36. Ceramic crowns were favoured less as compared to others i.e., 18% for tooth 16 and 21% for tooth 36. Refer fig 2 & 3.

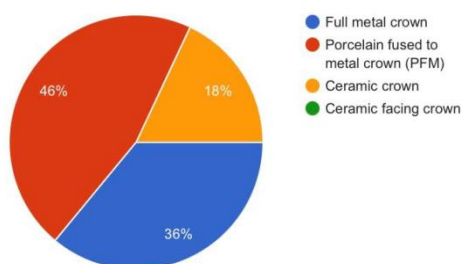


Fig 2: Favoured material for tooth 16

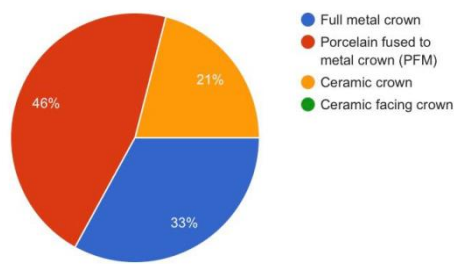


Fig 3: Favoured material for tooth 36

In the anterior region, ceramic crowns were preferred (98%) by participating dentists, followed by 2% ceramic facing crowns for tooth 11. Whereas, 60% of the population preferred PFM and 37% chose ceramic crowns for tooth 34 followed by very less preference to ceramic facing crowns (2%) and full metal crowns (1%). See *fig 4 & 5*.

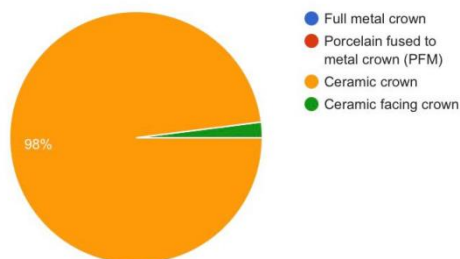


Fig 4: Favoured material for tooth 11

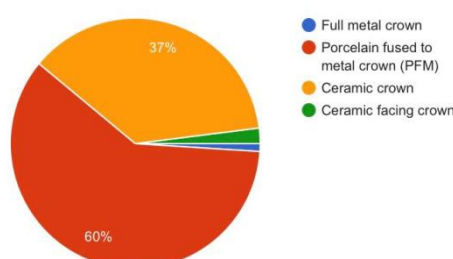


Fig 5: Favoured material for tooth 34

Participants who selected ceramics, preferred zirconia reinforced lithium silicate ceramic (76%) followed by monolithic zirconia ceramic (12%) and lithium disilicate ceramic (10%). Feldspathic/ leucite reinforced glass ceramic (2%) were chosen by a very less population. See *fig 6*.

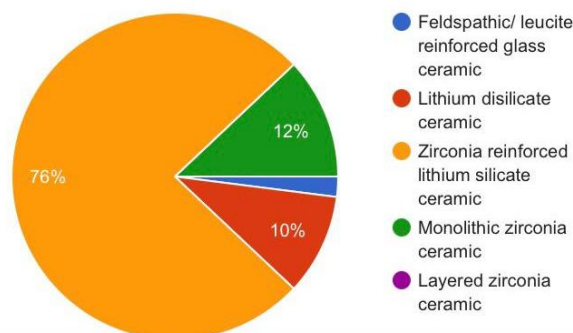


Fig 6: Type of ceramic chosen

VI. DISCUSSION

The recent survey outcomes indicate a patient preference for porcelain fused to metal (PFM) crowns irrespective of the abutment tooth's location. Notably, ceramic crowns are predominantly favored for front teeth, while PFM crowns and full metal crowns find preference for posterior teeth. In the case of tooth 34, participating dentists exhibit a preference for both PFM metal-fused-to-metal and ceramic crowns.

The study highlights variations in material preferences among dentists in Germany, the United States, and India. Indian dentists, unlike their German and American counterparts, tend to base their choices on the characteristics specific to their dental practices. Despite regional differences, ceramics remain a prevalent choice due to their versatility across various abutment tooth positions. In the United States, a scenario involving a single crown for abutment tooth 11 was presented, revealing a preference for lithium disilicate, followed by layered zirconia and conventional glass ceramics among participating dentists.

Comparing this latest survey with the previous one in the United States, a consistent scenario involving a single crown for abutment tooth No. 11 was presented. Historically, U.S. dentists favored porcelain fused to metal, followed by ceramics (lithium disilicate and monolithic zirconia). However, the current research identifies zirconia-reinforced lithium silicate as the material of choice. Interestingly, the study suggests that dentists prioritize ease of handling and evidence over aesthetic features, particularly in technically challenging situations.

The discussion emphasizes the importance of dentists' understanding of ceramic differences, crucial for selecting appropriate cementation procedures or material indicators. Notably, the study highlights the underrepresentation of CAD/CAM resin composites or polymer-infiltrated ceramic-network materials, possibly due to their complex nature requiring careful handling and adherence to manufacturer specifications. The need for increased post-secondary education, possibly through introductory articles, is emphasized to navigate the plethora of available products and mitigate confusion.

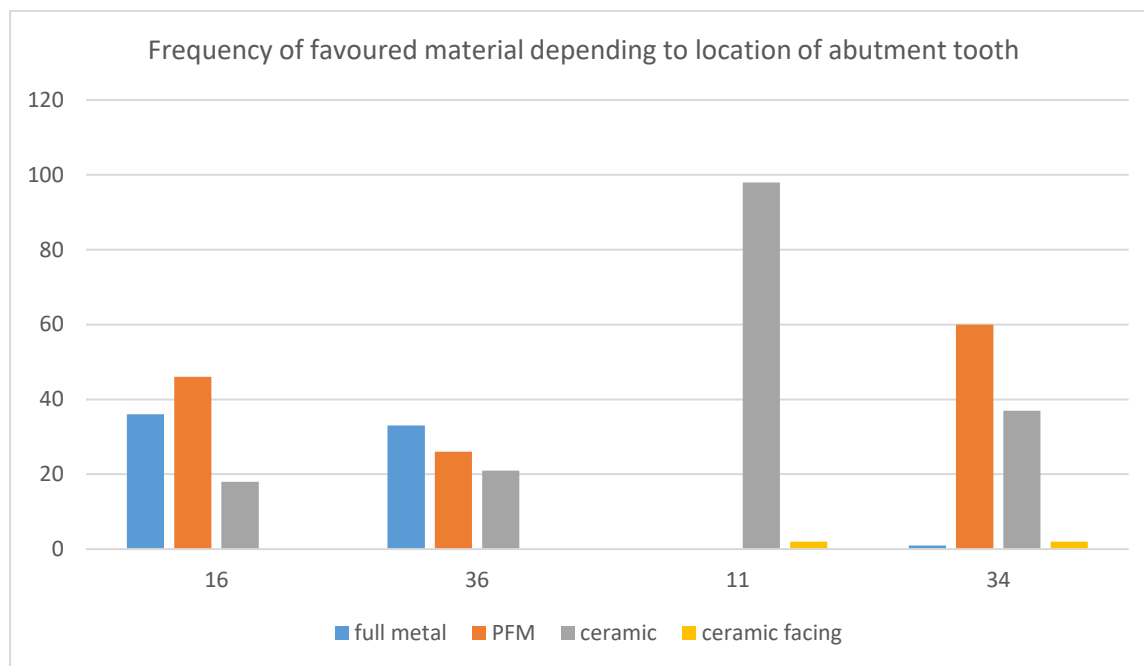


Fig 7. Frequency of favored material depending to location of abutment tooth

Acknowledging a limitation, the study notes that participants were presented with a limited set of hypothetical clinical scenarios. The absence of scenarios involving parafunctional activity patients and lower incisors may impact the exploration of potential differences in restorative approaches. Additionally, the study suggests that considering variations in SC layer thickness in different clinical scenarios could have provided valuable insights into material choices.

In conclusion, the study affirms that dentists tailor restorative material choices based on individual patient needs. The discussion underscores the potential for increased familiarity with modern tooth-colored materials through improved postsecondary education and knowledge dissemination.

VII. Conclusion

The conclusion of the study serves as a synthesis of the research findings, highlighting key observations and their implications for dental practices. This section aims to draw meaningful insights from the data collected and to contribute to the broader understanding of material preferences for tooth-supported single crowns (SCs) among dental professionals. The research, conducted between January 2023 and October 2023, involved 100 dental professionals who provided valuable insights into their material preferences for fabricating SCs on abutment teeth 16, 11, 34, and 36. The majority of participants expressed a preference for ceramic materials, with zirconia-reinforced lithium silicate ceramic being the most commonly specified within this category. Interestingly, there was a divergence in preferences for anterior and posterior SCs, with porcelain fused to metal (PFM) and full metal crowns being recommended more frequently for posterior teeth. The study's findings carry significant implications for dental practice, particularly in the context of material selection for fixed prosthodontics. The evident favoritism toward ceramics aligns with the contemporary trend of prioritizing esthetics, indicating a shift away from traditional metal-based restorations. This insight can guide dental

professionals in their decision-making processes, encouraging a more nuanced consideration of material choices based on the location of the abutment tooth. The conclusion underscores the potential impact of postgraduate education and information dissemination in enhancing dental professionals' expertise. The observed variations in material preferences suggest that ongoing education and awareness programs could play a crucial role in updating practitioners on the latest advancements in dental materials and their applications. This study adds a valuable layer to the existing body of knowledge regarding material preferences in prosthodontics. By honing in on the location of abutment teeth, the research provides a nuanced understanding of how clinical scenarios may influence material choices. This information contributes to the ongoing discourse on evidence-based decision-making in dental practices. The conclusion transparently acknowledges the limitations of the study, such as the reliance on self-reported data and the cross-sectional nature of the survey. The limited predefined answer options might have constrained the diversity of responses, and individual variations in clinical scenarios may not have been fully captured. These limitations open avenues for future research to delve deeper into specific aspects of material preferences. In light of the findings, the conclusion proposes areas for future research. Exploring the reasons behind the observed variations in material preferences, conducting longitudinal studies to track evolving trends, and assessing the long-term clinical outcomes of different materials are suggested as potential avenues for further investigation.

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